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FIELD WORK IN THE CONTROL OF THE ARGENTINE ANT

By L. J. NICKELS

In Berkeley at the present time we have two small, isolated colonies of Argentine ants (*Iridomyrmex humilis* Mayr). One colony covering originally about four blocks is situated in the southern portion of the city near Ashby Station; the other covering originally parts of two blocks is located a short distance from the University Campus.

These colonies have been known for at least two years; no attempt at control was made, however, other than that of the householders, which due to their lack of coöperation, proved unavailing.

The southern territory is covered for the most part with one-story frame dwellings. The one nearest the University is more diversified, one fifth of the area supports brick and stucco buildings, ranging from two to four stories in height, the remainder is covered by frame buildings two to three stories high, also two vacant lots, the larger of these about 150 ft. square has not been infested although ants were numerous in three sides of it.

The situation under observation represents extremely favorable conditions for the ant. The residents are not particularly careful in the disposal of their garbage and a bakery, butcher shop, and a hotel furnish a great abundance and never-ending supply of meat scraps and sweets.

Early in the fall of 1910 Professor Woodworth of this station (University of California Agricultural College, Department of Entomology) published Bulletin No. 207, "The Control of the Argentine Ant" in which the plan was suggested for controlling the insect,—the Argentine or other species, as the result of detailed studies, of using a weak arsenical poison.

About this time the residents of both districts appealed to the University and also the city authorities for help in controlling the pest which was not only proving a great annoyance but depreciating property values.

The work was started with an appropriation of five hundred dollars by the municipality.

In the description of the actual field work I shall limit myself to the minor territory, which I personally handled.

As in any control work, such as this, the extent of the district affected must first be determined. To do this a canvass was made from house to house, one block in all directions beyond the known limits of the foragers. In order to keep an accurate record, cards three inches by four inches were used, one for each city lot, one side being occupied by the street on which the house is situated with the number, also a plan of the lot, including the position of the house on the premises, considering the outer edge as the boundary. Ant nests, trails, trees, shrubs and bushes were indicated by suitable symbols. The reverse side was used for notes and a record of the treatment, each jar being allotted a number. The cards for each block were placed in a small paper folder to facilitate the handling as a unit.

The result of the preliminary examination showed the ants extremely abundant. Three fourths of the block were occupied by *Iridomyrmex humilis*, the remainder by *Prenolepsis imparis* Say.,—the honey ant

Practically every square yard of ground was visited by scouts or covered by trails. This was due in part to the fact that many small nests existed and secondly, since many of the houses are flats, there were at least four regular sources of food; in most cases carelessness with garbage furnished an intermittent source and this, together with a large number of scale-bearing trees, furnished ample subsistence for prosperity and rapid increase. Notwithstanding the presence of supplies upon the ground, the ants visited the upper stories of all the buildings. Trays brought to rooms on the fourth story of the hotel within a very short time would be literally covered with ants. On each floor refuse barrels were situated, which were visited constantly; the scraps about these gave sufficient incentive for the ants to come in a small but endless stream and so be on the lookout for all possible sources of food.

The baker, due to the invasion, at one time found it necessary to suspend business for a short period. The butcher found it exceedingly difficult to keep ants from his ice chest and the like.

Conversation with the residents brought out the fact that they had spent a good deal of time and money in driving the ants away only to bring on fresh visits. The ground in this locality is adobe,

the summer cracks offer a multitude of excellent nesting places, many stone sidewalks make disturbance of the colonies underneath impossible, so that on the whole the block is very favorable for the success of ants, and being successful proved amply that the average battle against the ant is fought upon the wrong end of the invasion.

For those who are not familiar with the control measures suggested in Bulletin 207, I will outline them briefly. A sponge moistened with sugar syrup containing 1-4 to 1-8 per cent sodium arsenite (Na As O_2) is placed in a suitable container with a perforated cover. The ants visit this receptacle and carry the syrup to the nest where it is fed to the brood and to the queen, slowly poisoning them, shutting off the increase of the colony which ultimately means utter extinction.

The next step after examining the territory was to prepare the poison. Pint screw-top jars have been found the best, easiest to handle and least liable to injury by exposure, of the more easily obtainable receptacles. The tops are prepared by breaking out the porcelain cap and making four holes with any suitable implement. A twenty-penny nail with its point filed flat and a round block made a very good punching outfit. One should expect to prepare about 100 jars an hour by this method. In all we are using about 350 jars, 300 furnished by the city and the remainder from the University stock (about 150 are being used in the block under discussion).

During this operation the first lot of poisoned syrup was prepared, using 20 pounds of sugar,—6 to 7 pounds of water and a fraction over an ounce of the arsenic, this being 1-4 per cent of the total weight. Sodium arsenite contains about 57½ per cent of arsenic so that the above quantity falls within the established limit. It was found necessary to heat the syrup mixture for about three hours in a water bath. The arsenite should first be dissolved in hot water before it is added to the sugar solution. In places where cheap molasses can be obtained, this could doubtless be used. On the Pacific Coast granulated sugar will give the cheapest syrup. About ten pounds of the liquid syrup to every one hundred jars is necessary for the first charging.

Ten pounds of sponges cut to about one half the size of the interior of the jar will give a sufficient number for 300. In manipulating the sponges it is best to sharpen the cutting knife after every slice and have them moist. This aids cutting and in the absorption of the sugar solution. The jars can be most quickly charged by first inserting the sponge and then pouring on about one half a gill of the liquid.

In beginning the actual poison work it was thought best to start on the most difficult situations. In the light of this the hotel was chosen as the starting point, 50 jars were distributed, mainly about

the kitchen and dining room. About half of these were visited intermittently, only three of the number were visited constantly. Within ten weeks from the start, the last of the ants disappeared from the hotel, and, to the great satisfaction of all concerned, have not returned. This is rather remarkable in that only about 1-4 pound of syrup was actually consumed. The expense was not over $25.00. Considering the fact that many patrons had left the hostelry because of the ants insisting upon dining with them and occasionally evading the cook and combining with the meal,—$25.00 is a small expenditure and the results extremely worth while.

As the work progressed, when it was established that jars were not being visited, they were moved to new locations. Towards the end of a campaign, the ants appear to be very migratory, appearing first here and then perhaps a hundred yards away.

For the ordinary city lot 8 to 12 jars are necessary. Rarely are they all visited at one time, as a rule only one or two are drawn upon constantly. The results, however, seem to indicate that it is only necessary for a small percentage of the foragers to invade a jar in order to insure the destruction of a colony.

The lots in the block under consideration are large. Twenty-three of these lots were infested and in every case ants are very much more scarce than formerly and in only about one fourth of them are any ants now present. When the work started at least 20 pantries were being constantly visited; since the beginning of the year we have only one record, this was the last house to be provided with jars and also the last to receive a spring re-charging.

In handling the jars the present experience suggests that

1. Better results might be obtained outside by shifting the jars a yard or so about every two weeks;

2. Jars inside a house do not need to have their locations changed frequently;

3. In damp situations or in rainy weather the jars had best be on their sides, first to exclude moulds and, secondly, to keep out rain water.

4. During the rainy season which probably compares with a very humid climate a sponge will stay moist for at least three months;

5. In dry weather moistening the sponge with a little water will keep them serviceable indefinitely;

6. An ordinary trail of ants will not exhaust a jar for a month or six weeks;

7. In no case have ants survived where a constantly visited jar has been twice emptied by the ants.

8. Where food is particularly abundant it may be advantageous to

supply the jars with a little extra bait, maple syrup or honey, and nests occurring in concrete sidewalks or in foundations can be stopped off by filling the cracks or entrance with a little plaster of paris. This has proved very effective.

I will give you the costs of the undertaking so far, which we estimate to be about four times as much as it will be in future work, due to the fact that since this was the first time systematic ant extermination has ever been attempted, it was thought wise to give the jars much more attention than will be necessary in future work.

Supplies for five blocks	$53.61
Labor at 40 cents per hour for the large territory and 50 cents an hour for the small amounted to	199.75
Total	$253.36

for six months work.

Now we will attempt to estimate what a square mile of control work will cost. In the average San Francisco section there are eight blocks to one side of the square and 17 to the other, in all giving 136 blocks and 50 miles of streets. If it were necessary to go from house to house and enter each yard from the street in order to make a circuit of the jars one would have to travel about 150 miles. A man can cover ten miles of street in this way a day. Two men could cover the territory once a week and $2,400.00 should furnish ample salary. So far we have expended about $10.00 a block for supplies. To insure safety one might consider $15.00 a square a safer estimate for the large territory, this gives $2,040.00 for supplies, totaling $4,440.00. About $500.00 should be added to this to pay the hire of an extra man occasionally and to insure against inefficiency, possible breakage, etc.

From this it will be seen that $5,000.00 will pay for a year's campaign per square mile of territory. This gives $37.40 as the cost for one block. Most squares have fifty subdivisions, this means about 75 cents per lot per year for poisoning and ultimate extermination. In case it be necessary to continue the work for more than one year it seems probable that another $1,000.00 should be enough to finish the work the second year.

For a large area like that in Oakland, Alameda, San José or Los Angeles the jars could be shifted on to new territory as fast as the old is cleaned up. Allowing a large margin of safety, subsequent sections of land should be taken care of for $3,000.00 or 45 cents to the lot per year.

In the small area in which the work is being done, the average expenditure by the residents was at least $25.00 in time and money per month

at the time the University took up the work. This shows the astonishing fact that the people were spending enough money on one block to practically exterminate the ants in nine when done in a systematic manner. And yet the ants were constantly spreading notwithstanding their efforts.

As I have said, the results so far are very satisfactory. We have established that it is possible to exterminate the Argentine ant and to absolutely prevent its spread.

LEGISLATION IN CANADA IN REFERENCE TO INJURIOUS INSECTS AND PLANT DISEASES

By C. Gordon Hewitt, D. Sc., *Dominion Entomologist, Ottawa*

The Department of Agriculture of Canada is empowered by the Destructive Insect and Pest Act of 1910 to take such action as may be deemed necessary to prevent the introduction or spreading of injurious insects, pests and plant diseases. All plants, with the exception of certain classes such as greenhouse-grown plants, herbaceous perennials, bulbs, etc., may be imported at certain seasons of the year only and through certain ports as specified in the Regulations. The Department of Agriculture has power to inspect plants liable to be infested with certain insects and plant diseases, to destroy the same if necessary or to prohibit their importation into Canada.

At six of the ports of entry (See Section 3 of the Regulations) fumigation stations are established where plants from countries and states infested or liable to be infested with the San José scale are fumigated with hydrocyanic acid gas by special officers in charge.

Plants from Europe, Japan and the states of Vermont, Maine, Massachusetts, New Hampshire, Connecticut and Rhode Island, six of the United States of America, are inspected by officers of the Department for the brown-tail moth and gypsy moth. In some cases this inspection is made at the port of entry, in other cases at the destination of the stock. In the latter case the plants may not be unpacked except in the presence of an inspector.

It is necessary for all persons and transportation companies importing or bringing plants into Canada to notify the Dominion Entomologist, Ottawa, of the fact, and through the coöperation of the Department of Customs, the custom officers at the ports of entry also send advices of the arrival of shipments of plants at the various ports through which plants may enter.

In addition to the inspection and fumigation of imported plants, a number of field officers are employed in inspecting orchards and in

carrying out eradicative measures against the brown-tail moth in those regions in Nova Scotia and New Brunswick infested with the insect. This eradicative work is carried out in coöperation with the respective Provincial Governments. The fumigation and inspection of imported plants and of infested regions and eradicative work is carried on under the direction of the Dominion Entomologist.

The Minister of Agriculture has power to prohibit the importation of plants from any given region should it be deemed necessary, owing to the presence of serious insect pests or diseases in such a region. This has been done in the case of potatoes from Newfoundland and the neighboring islands to prevent the introduction of potato canker (*Chrysophlyctis endobiotica*).

The Destructive Insect and Pest Act and the Regulations issued thereunder are appended.

In addition to the legislation of the Federal Government, certain of the Provincial Governments have instituted legislative measures in reference to plant diseases and pests.

The Province of British Columbia inspects all plants and fruit entering the province, and any plants or fruit found to be infested with insect pests is either treated or condemned.

The Province of Ontario has legislation chiefly referring to the inspection of nurseries and the treatment of plants grown in nurseries.

The Province of Nova Scotia has recently enacted legislation under which the Department of Agriculture for the province will have power to inspect orchards and take such steps as are necessary for the eradication or control of the more serious insect pests and plant diseases.

THE DESTRUCTIVE INSECT AND PEST ACT

An Act to Prevent the Introduction or Spreading of Insects, Pests and Diseases Destructive to Vegetation

(9–10 Edward VII, Chap. 31. Assented to 4th May, 1910.)

His Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:

1. This Act may be cited as "*The Destructive Insect and Pest Act.*"

2. In this Act, unless the context otherwise requires, "the Minister" means "the Minister of Agriculture."

3. The Governor in Council may make such regulations as are deemed expedient to prevent the introduction or admission into Canada, or the spreading therein, of any insect, pest or disease destructive to vegetation.

4. Such regulations may provide:

(a) for the prohibition generally, or from any particular country or place, of the introduction or admission into Canada of any vegetable or other matter likely to introduce any such insect, pest or disease;

(b) the terms or conditions upon, and the places at which any such vegetable or other matter may be introduced or admitted into Canada;

(c) for the treatment and manner of treatment to be given to any vegetation, vegetable matter or premises in order to prevent the spreading of any such insect, pest or disease, and may prescribe whether such treatment shall be given by the owner or by a person appointed for such purpose;

(d) for the destruction of any crop, tree, bush or other vegetation or vegetable matter or containers thereof infested or suspected to be infested with any such insect, pest or disease;

(e) for the granting of compensation for any such crop, tree, bush or other vegetation or containers thereof so destroyed, such compensation not to exceed two thirds of the value of the matter destroyed and to be granted only by the Governor in Council upon the recommendation of the Minister;

(f) for the prohibition of the sale of any vegetable matter infected with any such insect, pest or disease;

(g) that the occupier of the premises on which is discovered any such insect, pest or disease shall forthwith notify the Minister and shall also send specimens of such insect, pest or disease;

(h) for the confiscation of any vegetable matter and the container thereof, if any, in respect of which a breach of this Act, or any regulation made thereunder is committed and generally for any other purpose which may be deemed expedient for carrying out this Act, whether such other regulations are of the kind enumerated in this section or not.

5. The Minister may appoint inspectors and other officers for carrying out this Act and the Regulations made thereunder.

2. Such appointments, if not confirmed by the Governor in Council within thirty days of the date thereof, shall lapse and cease to be valid.

6. Any inspector or other officer so appointed may enter any place or premises in which he has reason to believe there exists any such insect, pest or disease, and may take specimens thereof and also of any vegetable matter infested or suspected of being infested therewith.

7. The Minister, upon the report of any inspector setting forth a reasonable belief of the existence of any such insect, pest or disease in any area defined in such report, may prohibit the removal from such area or the movement therein of any vegetation, vegetable or other matter which, in his opinion, is likely to result in the spread of such insect, pest or disease.

8. Every person who contravenes any provision of this Act, or any regulation made thereunder, shall be liable, upon summary conviction, to a fine not exceeding one hundred dollars, or to imprisonment for a term not exceeding six months, or to both fine and imprisonment. Any vegetable or other matter imported or brought into Canada contrary to this Act, or to any regulation made thereunder, shall be forfeited to the Crown.

9. Every order in council and regulation made under this Act shall be published in *The Canada Gazette*, and shall be laid, by the Minister, before Parliament within fifteen days after the commencement of the then next session.

10. The "*San José Scale Act*" is repealed.

Regulations

issued under the Destructive Insect and Pest Act,
(by order in Council of 27th February, 1911.)

1. "Inspector" means a person appointed for carrying out the provisions of the Destructive Insect and Pest Act and the regulations made thereunder.

2. No tree, plant or other vegetation or vegetable matter infested with any of the

insects, pests or diseases, to which this Act applies, shall be imported into Canada except as hereinafter provided.

3. Nursery stock, including all trees, shrubs, plants, vines, grafts, scions, cuttings or buds which are not hereinafter exempted, entering Canada shall be imported only through the ports and during the periods respectively hereinafter mentioned, that is to say:

Vancouver, B. C., from October 1 to May 1.

Niagara Falls, Ont., from October 1 to May 15.

Winnipeg, Man., and St. John, N. B., from March 15 to May 15, and from October 7 to December 7.

Windsor, Ont., and St. Johns, P. Q., from March 15 to May 15, and from September 26 to December 7.

At these points of entry the importations shall be fumigated in the fumigation houses provided for that purpose, and a certificate of fumigation will be issued, without which no stock may be taken out of bond.

Importations by mail shall be subject to the same regulations.

All nursery stock originating in Japan or in any one of the states of Vermont, New Hampshire, Maine, Massachusetts, Connecticut and Rhode Island, six of the United States of America, shall, after fumigation, be subject to inspection as provided by Section 6 of these Regulations.

Provided, however, that the following vegetation and florist's stock shall be exempt from fumigation and may be imported at any season of the year and through any port without inspection:

(*a*) Greenhouse-grown plants, including roses in foliage which have been grown in pots up to three inches in diameter but not larger. A certificate that the plants have been grown under glass must accompany the invoice and shall be signed by the consignor.

(*b*) Herbaceous perennials (the stems of which die down in winter), such as perennial phlox, peonies, sunflowers, etc.

(*c*) Herbaceous bedding plants (such as geraniums, verbenas, pansies, etc.)

(*d*) Bulbs and tubers (such as hyacinths, lilies, narcissi and other true bulbs and also the tubers of dahlias, irises, etc.)

(*e*) Cottonwood or Necklace Poplar (*Populus deltoides*) when shipped from and grown in Dakota or Minnesota, two of the United States of America.

4. The port by which it is intended that the nursery stock shall enter shall be clearly stated on each package and all shipments made in accordance with these regulations will be entirely at the risk of the shippers or consignees, the Government assuming no responsibility whatever.

5. All persons importing nursery stock, except such as is exempt from fumigation or inspection under Section 3 of these Regulations, shall give notice to the Dominion Entomologist, Experimental Farm, Ottawa, within five days of dispatching the order for the same, and they shall again notify the Dominion Entomologist on the arrival of the shipment in Canada.

Notice shall also be given to the Dominion Entomologist by all transportation companies, Custom House Brokers or other persons importing or bringing into Canada nursery stock that is subject to inspection as hereinafter provided, immediately such a consignment is received by them. Such notice shall include the name of the consignor and the consignee, the points of origin and destination, the name of the company carrying the nursery stock, as well as the nature, quantity and origin of the same.

6. Nursery stock, not including such stock as is exempt under Section 3 of these Regulations, originating in Europe, shall be imported only through the ports and

during the periods specified under Section 3 for stock requiring fumigation, with the addition of the ports of Halifax, N. S., Sherbrooke, P. Q., and Montreal, P. Q., through which ports such European stock may enter from September 15 to May 15. Such European nursery stock, and such other imported vegetation, as the Minister may determine, entering Canada, shall be exempt from fumigation, but shall be inspected either at the port of entry or at its destination to which it may be allowed to proceed, but in the latter case it must not be unpacked except in the presence of an inspector.

7. If, on inspection, nursery stock or other vegetation or vegetable matter is found to be infested with any of the insects, pests or diseases hereinafter specified, it shall be destroyed to the extent deemed necessary by the inspector and in his presence. All cases, packages and packing in which such stock has been contained shall also be destroyed in the same manner.

8. Any inspector entering any lands, nursery or other premises where there is reason to believe that any of the insects, pests or diseases hereinafter specified are or may be present, shall give instructions for the treatment or destruction of any tree, bush, crop or other vegetation or vegetable matter or the containers thereof, which may be found or suspected to be infested with any of the insects, pests or diseases hereinafter specified, and such instructions shall be carried out by the owner or the lessee of the infected or suspected vegetation, vegetable matter or containers thereof, and such remedial treatment shall be carried out and continued until the insect, pest or disease shall be deemed by the Inspector to have been exterminated.

9. Compensation not exceeding two thirds of the value as assessed by the Inspector, of the vegetation or vegetable matter or containers thereof destroyed by the instructions of an Inspector, shall be granted by the Governor in Council upon the recommendation of the Minister.

10. It shall be illegal to sell, offer for sale or in any way dispose of or receive any trees, shrubs, or other plants, vegetable matter or portions of the same, if the same are infested with any of the insects, pests or diseases hereinafter specified.

11. The owner, occupier or lessee of any premises or place where any of the insects, pests or diseases specified herein shall be found, shall immediately notify the Minister and shall also send to him specimens of such insects, pests or diseases.

12. The destructive insects, pests and diseases to which the said Act shall apply shall include the following:

The San José Scale (*Aspidiotus perniciosus*).
The Brown-tail Moth (*Euproctis chrysorrhœa*).
The Woolly Aphis (*Schizoneura lanigera*).
The West Indian Peach Scale (*Aulacaspis pentagona*).
The Gypsy Moth (*Porthetria dispar*).
Potato Canker (*Chrysophlyctis endobiotica*).
Parasitic diseases affecting potatoes externally or internally.
Branch or Stem Canker (*Nectria ditissima*).
Gooseberry Mildew (*Sphærotheca mors-uvæ*).
White Pine Blister Rust (*Peridermium strobi*).

13. The importation of potatoes into Canada from Newfoundland or the Islands of St. Pierre or Miquelon is prohibited.

14. The Minister may, upon special request to that effect, authorize the importation into Canada of any insect, pest or disease hereinafter specified, but for scientific purposes only.

15. The Regulations made under the "San José Scale Act" are repealed.

ORGANIZED EFFORTS AS A FACTOR IN THE CONTROL OF THE CITRUS WHITEFLY

By A. W. Morrill, *Phœnix, Arizona*

The problem of the control of the citrus whitefly has long been generally recognized as more difficult than that offered by any other citrus pest now established in the United States. This rating, which has very properly been given, is due to the power of flight possessed by both sexes of the adult insects combined with most of the worst characteristics as to habits, rate of multiplication and destructiveness possessed by true scale insect pests.

An important feature of the problem of whitefly control by means of the methods at present available for general use—spraying and fumigation—is that of extending the availability of these methods by securing the necessary coördination of efforts among the owners of neighboring citrus groves. Recent experimental work has resulted in bringing the direct remedies mentioned within the reach of the owners of isolated groves and of citrus growers in all localities where coöperative associations have been organized for combating the whitefly. While it is true that the pest may be controlled by the intelligent and persistent use of direct remedies under less favorable conditions than these, there remains the problem of securing the best practicable condition of control upon the most profitable basis. The writer is confident that any such a condition or anything approaching it can be brought about only through proper legislative enactments. Such action on the part of the state legislatures may be effectively supplemented by coöperative protective associations among the citrus growers and also by fruit marketing organizations. It is the object of this paper to present the ideas of the writer concerning these subjects, which ideas have been derived from a general knowledge of citrus conditions in the Gulf Coast States and more particularly from three years' connection with the whitefly investigations of the United States Department of Agriculture in Florida.

Losses from the Whitefly and Estimated Expense of Competent Supervisory Organizations

The citrus whitefly (*Aleyrodes citri* R. and H.) and the cloudy winged whitefly (*Aleyrodes nubifera* Berger) cause annual losses in Florida, Louisiana and Texas amounting to at least one and one-half

million dollars per year.[1] In two counties in Florida (Manatee and Orange) the losses from whiteflies amount to fully two hundred thousand dollars each per year and in several others it amounts to more than one hundred thousand dollars per year. With losses such as these, usually representing in infested groves between one third and one half the value of a crop, practically all business interests in important citrus fruit producing localities are vitally concerned. Bankers and merchants for example, even though not owners of citrus groves, are in many localities in Florida fully as much dependent in a business way on the citrus fruit crops as is the average grower. It is a noteworthy fact, moreover, that in many important business centers in Florida, such as Orlando, Bartow and Fort Myers a large percentage of the bankers, merchants and professional men are grove owners or part owners and are consequently doubly interested in the success of the citrus industry.

The first point for consideration in connection with suitable legislative enactments is the extent to which expenditures by state or county are justified. According to the estimates of the writer, the expense of a suitable supervisory organization would be insignificant beside the direct benefits that would result and moreover would be fully compensated for by the incidental reduction in the amount of injury by scale insects.[2] An amount between five and ten per cent of the total losses resulting from whitefly attack on the basis of a forty per cent damage in each infested grove should be ample to cover such expense. In countries or localities where the whiteflies do not exist or where they infest only a small percentage of the citrus groves, not more than one per cent of the gross value of the citrus crop should be necessary for checking the spread of the insects in order to delay to the utmost the time when the infestation in the county or locality will be general. These estimates of the amount, which will be needed for the carrying out of a program of whitefly control supported by legislative enactment, indicate in a general way the necessary expense for different sections. In Florida, the leading citrus fruit growing counties such as Orange, De Soto, Manatee and Polk, would require in the writer's opinion from eight to ten thousand dollars annually for the support of efficient county organizations created in accordance with the provisions of a state law. Other counties in which citrus growing interests are less important would require smaller organi-

[1] The writer estimates that more than four fifths of this loss is caused by the citrus whitefly and less than one fifth by the cloudy winged whitefly. The discussions which follow apply to both species except as affected by the latter species being confined to citrus as a food plant.

[2] Bul. 76, Bur. Ent., U. S. Dept. Agric., p. 60–62.

zations and proportionately smaller expenditures and the work of combating whiteflies in some cases could be conducted to best advantage by means of one organization supported jointly by two or more adjoining counties.

Organization of Officials for Efficient Service

In Florida the office of State Horticultural Commissioner would be practically superfluous as regards whitefly control. Rather than create such an office, the writer would strongly recommend that offices already existent in connection with the State Experiment Station be given additional support. It would be especially undesirable and a serious impediment to progress in whitefly control for an organization to be provided for, which would place a State Horticultural Commissioner or other official in charge of all the work of the state. For effective results the officials in charge must have an opportunity to come in close contact with actual field conditions having supervision over the work in limited territories—only a single county in many instances. They must be competent as to entomological matters, of good executive ability, and must be able to command the respect and confidence of the citrus growers. Such men must be as able men in their line as it is possible to procure and should not be subject to the direction of an official superior.

An assistant to the official in charge, capable of acting in charge of all work temporarily as the occasion may demand, one or two inspectors and an office assistant are needed to complete the organization in a leading citrus growing county. The attempt to accomplish satisfactory results in combating the whiteflies in Florida in such counties as Orange, Lake, Polk, Lee, De Soto, Manatee and Hillsboro with a smaller organization than that mentioned would be a serious mistake, at least until such time as a satisfactory condition of control is brought about and experience shows the practicability of reducing expenses in this manner.

The organization of the various county entomologists into a State Crop Pest Commission as hereafter outlined is advisable in order to give each local official status as a state officer for legal reasons, in order to establish state quarantines when necessary and also to secure as far as practicable uniformity of methods in administering the State Horticultural Law in the different counties.

State Laws

The states of Louisiana and Texas already have horticultural laws which, with proper financial support, might be administered to good effect in the control of whiteflies. Dealing with trees which average

much smaller in size, the control of whiteflies by spraying and fumigation in these states as compared with Florida is not a difficult matter. Certain modifications of these existing laws are desirable, however, while in Florida an existing law which authorizes the appointment of county boards of horticulture and which is now ineffective through disuse and inadequacy should be entirely repealed to prevent future confusion. In its place a carefully drawn law is needed, especially adapted to meet local conditions and embodying such features as investigations of the whiteflies have shown to be advisable.

In accordance with the views of the writer the following are essential features of such a law:[1]

1. The County Commissioners or Supervisors of any county should be authorized to appoint a County Entomologist upon receiving a petition to do so from at least twenty-five fruit growers, provided that when the horticultural interests in two or more adjoining counties are comparatively small a single official may be appointed jointly by the commissioners of the several counties upon petition from twenty-five fruit growers in each county concerned.

2. It should be required that these appointments be made from an approved list of available economic entomologists maintained by a state committee on credentials consisting of the governor of the state, the president of the State Horticultural Society and the director of the State Agricultural Experiment Station.

3. The various county entomologists appointed as above should be constituted into a State Crop Pest Commission.

4. The Entomologist of the State Agricultural Experiment Station should be designated the State Entomologist.

5. County entomologists should be appointed for a specified period, not less than two years nor more than four years being advisable. Dismissal by the county commissioners at any time should be authorized in the case of inefficiency or neglect of duty, but only with the approval of the State Committee on Credentials following a hearing by that committee.

6. Each County Entomologist should be authorized to appoint such assistants as may be necessary with the approval of the County Commissioners. Regularly appointed assistants or inspectors should be granted all of the authority given to the County Entomologist when

[1]Anyone interested in the constitutionality of any of the features herein recommended if enacted in a state law should consult the court decisions in California cases. The definitions of nuisances in these cases are especially valuable. These decisions are published by the state of California in a pamphlet entitled "California's Horticultural Statutes with Court Decisions and Legal Opinions Relating Thereto (Sacramento 1908)."

working under the direction of the latter. Authority should be granted the County Entomologist to promulgate rules which are consistent with the state law concerning the details of its execution as far as it relates to county work. He should be authorized to quarantine against the importation of nursery stock or plants of any kind from other counties, and to make such inspections as they may deem advisable of nursery stock or plants imported from other counties in the state or from other states or territories and from foreign countries. He should be authorized to require defoliation, treatment with insecticides or the fumigation of plants imported into the county from other counties, or of plants offered for sale within the county when necessary to prevent the spread of insect pests. He should be authorized to inspect nurseries, orchards, groves, vineyards, trees, vines, plants and fruits as far as practicable to protect the horticultural interests within his jurisdiction and to serve legal notices requiring specified measures for the control or eradication of insect pests when necessary. He should be authorized to enter upon any premises at any time for the purpose of performing any of the duties required of him by the law. Authority should be given to the county entomologists to regulate, with the approval of the county commissioners of the respective counties, the planting of new citrus groves so as to prevent in the future losses to owners of isolated groves or groves in isolated groups through the interference with the advantages of such isolation, also, so as to prevent new plantings interfering in any way with the control of the whitefly or other pests in groves already established.

7. When an orchard, grove or plants on any premises are found to be infested with an insect injurious to the horticultural interests of the county, and effective remedies or methods of eradication are known, then it should be the duty of the County Entomologist to declare the infested trees, plants or premises public nuisances and to serve a legal notice as heretofore stated requiring specified remedial measures or methods of eradication within a specified time. When any person or persons upon whom such notice has been served refuses or neglects to abate the nuisance as directed, or when, owing to the absence from the county of the owner or owners, it is impossible to serve the notice, it should be the duty of the County Entomologist to cause the nuisance to be abated by means of the most economical control measures available, including when necessary, the complete or partial destruction of the infested plants, fruits or articles. When performed by the entomologist or his authorized assistant, the expense should be borne by the county and become a lien on the property subject to legal action for recovery. Plants, trees or shrubs, which are not fruit producing,

and which are subject to infestation by species of insects injurious to horticultural interests, should be defined as public nuisances whether or not injurious insects actually exist thereon and it should be the duty of the County Entomologist with the approval of the county commissioners to condemn any such plants, trees or shrubs when necessary to protect said interests.

8. Regulations should be included in the state law governing the importation of plants into the state of Florida. It should be required that importations of plants be accompanied by a certificate of inspection from an authorized state or government entomologist or inspector; also by a complete invoice from the shipper showing the contents of the shipment and the place where the plants were grown. Any person, persons or common carriers bringing or causing to be brought into the state plants of any kind should be required to hold such plants, immediately notifying the County Entomologist or the State Entomologist in case no County Entomologist has been appoihted. It should be the duty of the County or State entomologist to inspect such imported plants within twenty-four hours after receiving notice of their arrival. Such plants should not be delivered until the common carrier and consignee have each been furnished with a certificate of release by the proper entomologist or his duly authorized agent. If imported plants are found to be infested with injurious insects which are not of general occurrence in the county, the entomologist should be authorized to condemn or disinfect. In the former case the plants should immediately be shipped out of the state by the consignee or should be destroyed under the direction of the County or State entomologist at the expense of the consignee. If in the opinion of the entomologist fumigation with hydrocyanic acid gas or treatment with an insecticide will render the plants innocuous, the expense of such treatment as he may decide upon should be borne by the consignee.

9. The most important duty of the county entomologists in citrus fruit producing counties should be defined in the state law as promoting the horticultural interests of their respective counties by supervising the control of insect pests, particularly whiteflies, by organizing and aiding in the organization of citrus growers into local protective associations, in acting as advisors to such associations and individual owners and in coöperating with them in bringing insect pests into a condition of control and in maintaining this condition.

10. The State Crop Pest Commission should be required to meet once a year for the transaction of business. The State Entomologist should be designated as *ex officio* chairman and a vice-chairman and a secretary should be elected by the members. The commission should be authorized to declare quarantines prohibiting the impor-

tation into the state of designated species of plants from designated states and territories when the danger of importing any pest warrants such action. They should be authorized to take such steps and to transact such business as may be necessary to improve the methods of combating insect pests and to secure uniformity of rules and practices as far as practicable among the officials representing different counties or groups of counties. As state officers the members of this commission should be granted the same authority as specified for county entomologists.

11. The State Entomologist should be authorized to employ such assistants as are needed to inspect plants of all kinds imported from other states, territories or foreign countries and destined for points in counties in the state in which no county entomologists have been appointed, also to maintain quarantine stations at designated ports of entry. The State Entomologist or his agent should be authorized to destroy or disinfect fruit or plants received at such ports and found to be infested with insect pests which do not occur or are not of general distribution in the state. The duties of the State Entomologist should be further defined to provide for his coöperation with the county entomologists by importing and breeding beneficial insects and by the importation and dissemination of fungous diseases useful in the control of injurious insects, also by introducing into the state improved apparatus and methods used in the control of insect pests in other states or in foreign countries.

12. In addition to the foregoing provisions citrus growers should be protected in the use of insecticides at all times. It should be required that the manufacturer of every insecticide offered for sale in the state register his product by name, also the formula, at the office of the State Commissioner of Agriculture. Provisions for the analysis of these insecticides by the State Chemist should be made, and it should be declared unlawful for the registered name to be used for any other formula or combination of the ingredients than that recorded in the original registration. In other details the National "Insecticide Act of 1910" should be followed.

13. Suitable penalties should be prescribed for the violations of the law and for the intentional interference in any manner with its operation.

14. An adequate appropriation should be made for the work of the State Entomologist and for defraying the expenses of the members of the State Committee on Credentials and of the State Crop Pest Commission in connection with meetings, as their duties or the law may require.

Features to be Avoided in Drafting a State Horticultural Law

The State Committee on Credentials should be allowed to maintain a list of the most experienced economic entomologists available, without restrictions as to confining such list to residents of the state. Examinations for the position of County Entomologist should not be required, since among those whose experience should entitle them to consideration the results of an examination would be deceptive and set a false standard. In recognition of the great difference in the extent of horticultural interests in the different counties, the amount of the salary to be paid entomologists should not be specified or restricted in any way by the state law. No more points should be covered by the law than are necessary to secure effective results in the control of insect pests. Particular care should be taken that no duties impracticable or impossible to accomplish be imposed on any official.

Rules and Regulations by County Entomologists

With the authority given by the state law the rules and regulations which should be adopted by a County Entomologist—made effective if necessary through county ordinances—in important citrus fruit growing sections should include the following:

a. All china and umbrella trees, privets, cape jessamines, wild persimmons, prickly ash and other food plants of the citrus whitefly which are so located within the county limits as to be subject to infestation by the citrus whitefly and liable to interfere with control measures against this insect in citrus groves, or liable to aid in the further dissemination of the species should be ordered destroyed and further plantings of any of these trees or shrubs within the county limits should be prohibited.

b. All citrus nursery stock for planting within the county limits should be completely defoliated at the nursery where grown or before shipment into the county, with such exceptions as may be consistently made by the Entomologist.

c. Any person or persons engaged in general contracting for spraying, fumigating or other operations for the purpose of controlling whiteflies or other citrus pests or who may undertake under any form of agreement to assume the responsibility for spraying, fumigating or other operations except in the capacity of laborer or employee should be required first to obtain a license from the County Commissioners to perform such work. Such licenses should be granted only upon the recommendation of the Entomologist after satisfying himself as to the capability of the person or persons applying for the same and as to the suitability of the apparatus, fumigating tents or other outfits with which the work is to be performed.

d. With the authority to regulate new citrus plantings granted by the state law as recommended herein, it should be required that written permits to locate each new grove be obtained from the County Commissioners. These permits should be granted only upon the recommendation of the Entomologist following fixed rules as far as practicable, after he has made due examination of the surroundings and found that a citrus grove in the proposed location does not materially interfere with the control of the whiteflies in groves already established.

The Enactment and Operation of a Horticultural Law in Florida

Anyone familiar with the history of the whitefly in Florida, its methods of spreading, the important part that infested nursery stock and worthless china and umbrella trees have played in its dissemination and the present annual damage from the insect, cannot but realize that millions of dollars would have been saved to the state by a horticultural law enacted ten or fifteen years ago. Even if nothing more had been accomplished than the elimination of the more important non-fruit producing food plants of the citrus whitefly and the compulsory defoliation of citrus nursery stock before shipment from infested nurseries for planting in uninfested sections, such a law would have been a success and by having restricted the spread of the insects would have represented a saving at the present time of three quarters of the present annual losses, or more than three quarters of a million dollars per year in Florida alone. The establishment of quarantine stations at ports of entry as suggested in the law herein proposed, probably would incidentally have excluded the woolly whitefly (*Aleyrodes howardi* Q.) recently introduced at Tampa, Florida,[1] from Cuba and also several other insect pests of subtropical fruits introduced from foreign countries during the past few years.

Although the long delay on the part of the Florida citrus growers in demanding legislative action has resulted in great injury to their interests and in a broad sense to the business interests of the entire state, this injury is not entirely irreparable. Many of the most progressive citrus growers object that the difficulty in securing the necessary support would be so great as to make the attempt to enact and execute a horticultural law impracticable. A similar objection, only five years ago believed to be insurmountable, against the organization of citrus growers for the marketing of fruit on the California plan had the same value as determined by subsequent events, as objections which may now be raised against the organization of warfare against Florida's worst citrus pest. An effective horticultural law is practicable in Florida and the securing of public sentiment which is necessary for its support requires no more energy than was expended in the organization of the Florida Citrus Exchange two years ago.

It should be recognized that the idea of a horticultural law in Florida will meet serious objection as long as its proper scope and greatest opportunities of usefulness are misunderstood. The principal duties of county entomologists according to the plan proposed by the writer are outlined in paragraph nine of the suggested features of the horticultural law. All citrus growers who desire to maintain their groves

[1]Bul. 64, Part VIII, Bur. Ent. U. S. Dept. Agric.

in the highest state of productiveness should welcome the assistance and coöperation which such a law would provide. These growers usually need protection from neighboring citrus groves whose owners are absent, leaving incompetent men in charge, or whose owners for other reasons are indifferent or would fail to coöperate in whitefly control except under compulsion. Even in such cases, however, the law would operate to advantage since, if the owner failed to take action when directed to do so, treatment by spraying or fumigation would be done by the county, the owner would be compelled to pay for the work and incidentally find it necessary to profit by the control of the insects.

When citrus groves or trees are of so little value as not to justify the expenditures necessary to whitefly control, the complete destruction of the trees is advisable and will naturally follow the administration of the law. There are today in Florida thousands of citrus trees which are a detriment to the citrus industry of the state; trees which are unproductive and which occupy space which could be more profitably used by the owners. In other cases growers are financially unable to control the whitefiy owing to their holdings being too extensive. In such a case the enforcement of a law requiring the control of the whitefiy, necessitating the disposal of a portion of the grove concerned, would be an actual benefit to the owner as well as to the community interests. In many cases one half the acreage now under one ownership, better cared for culturally and with the insect pests brought under control would yield a net profit as large or much larger than the entire property under the present conditions.

Still further changes are demanded and would naturally follow the operation of a horticultural law with advantage to all concerned. The control of many insect pests has made necessary extensive changes in farm and orchard practices. Frequently the changes in the methods of culture developed by an entomological investigation are in the main changes which would be of advantage even if adopted before the appearance of the insect pest concerned. This is the case with the whiteflies which attack citrus trees in Florida.[1] Much has been accomplished in the last few years in the adaptation of fumigation and spraying to whitefly control under Florida conditions, but radical measures are frequently required to place the use of these direct remedies upon the most practicable and profitable basis. These measures consist in reducing the height of citrus trees, when excessive, and in reducing the number of trees to the acre when they are so closely planted as to interfere with control measures. In the opinion of the writer the height of citrus trees wherever the citrus or cloudy winged whiteflies occur should not exceed twenty-five feet. The branches of adjacent trees

[1]Bul. 76, Bur. Ent. U. S. Dept. Agric., p. 14; Circular 111, p. 10–11.

should not interlock since this seriously interferes with both fumigation and spraying.

Briefly stated, citrus groves should be made to conform to the requirements of effective and economical whitefly control regardless of the apparent sacrifices. To illustrate the situation: If the normal annual rainfall in Florida were to be decreased from fifty inches to ten inches a radical change in the methods of producing a citrus crop would be required and the fact that comparatively few citrus groves are at present piped or trenched would not make irrigation impracticable or any the less effective. Similarly the fact that many citrus groves in Florida are at present very poorly adapted to the use of direct remedies for whiteflies does not detract from the availability of these remedies or furnish a sound argument against the adoption of a systematic campaign for whitefly control along the lines outlined in this paper.

The Search for Enemies of the Citrus Whitefly as Affecting the Desirability of Immediate Action toward Control by Direct Means

For years Florida citrus growers have been interested in the possibility of foreign explorations locating the original home of the citrus whitefly and in the possibility of discovering there effective natural enemies. In the investigations of whiteflies begun in 1906 efforts in this line have naturally been preceded by field investigations which were certain to give practical results. The principal results of these investigations are now being published by the Bureau of Entomology. As a result of our present knowledge of the whiteflies, contributed to by the investigations of the United States Department of Agriculture and by the Florida Experiment Station, citrus growers in Florida are now confronted by the opportunity to begin at once a practicable organized effort to bring the whiteflies into a state of control. The question naturally arises: Is such an undertaking advisable as long as there exists the possibility of discovering and introducing an effective natural enemy? This can be determined only by means of an examination of the history of similar efforts to discover and introduce beneficial insects. The following facts and conclusions are based upon an examination of most of the important literature on this subject:

1. There are on record more failures than successes in the endeavors made in the various parts of the world to control imported insect pests by means of natural enemies secured by foreign explorations.

2. The success of the Australian lady bug (*Novius cardinalis*) in controlling the cottony cushion scale in California, resulting in complete commercial control within a few months after its introduction,

is generally conceded by entomologists to be extraordinary and not to be expected except in rare instances.

3. Ordinarily it may be expected that it will require several years for an introduced beneficial insect to become effective over a large extent of territory.

4. Many attempts may be necessary before the successful introduction of a beneficial insect is accomplished.

5. There are instances of complete failures of repeated attempts to introduce beneficial insects into new regions, the reasons not being definitely known, but presumed to be due to the differences in climatic conditions.

6. Parasitic or predatory insect enemies may appear to accomplish the complete control of an insect in its native home and prove of little commercial importance against the same insect pest when introduced into another region.

7. There is a danger of native hyperparasitic insects attacking the introduced beneficial species and preventing its multiplying rapidly enough to become useful.

8. The apparent control maintained by a beneficial insect and observed by foreign explorers may be due to characteristics of the food plant of the insect pest. The food plants in the native home may have become adapted to resist the injurious effects of the insect and the predaceous or parasitic enemies may consequently appear effective when in reality such enemies would be ineffective without these plant adaptations.[1]

9. Notwithstanding the preponderance of unfavorable probabilities and possibilities, the importance of making every effort to secure successful natural enemies, or enemies which will contribute to a condition of successful natural control of serious insect pests is second only to the importance of taking immediate steps to control such pests by the means at hand.[2]

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[1] This conclusion is suggested by a memoir of Prof. Paul Marchal (English translation in *Popular Science Monthly*, Vol. LXXII, page 417) and appears to the writer as well within the range of possibilities in the case of the citrus whitefly. The discussion of the food plant adaptations of this species by the present writer and Dr. E. A. Back in a recent publication shows that the pomelo or grape fruit possesses certain characteristics which are decidedly unfavorable to the multiplication of the insect to an injurious extent. The foliage, of the orange in the native home of the whitefly therefore, would have only to adapt itself so as to possess the same or similar characteristics as exist in the foliage of the Florida types of grape fruit in order to become nearly immune to the insect.

[2] The words of Prof. Marchal may be aptly quoted in this connection (*Popular Science Monthly*, Vol. LXXII, page 419): "Confidence in the assistance we can get occasionally from parasites and predaceous insects should not make us lose all prudence nor prevent us from seeking a guard against the perils that surround us, in organizing at our large ports an inspection and disinfection service—and in a general way taking every measure possible to protect our crops."

The foregoing more or less generalized conclusions applied to the present whitefly situation in Florida lead to the belief that even if an effective natural enemy of the citrus whitefly were already successfully established in that state and had shown its ability to thrive there, whitefly losses would in all probability amount to three or four million dollars before a condition of commercial control could be accomplished in the average grove. Florida citrus growers have no better justification for inactivity in the control of the citrus and cloudy wing whiteflies pending the results of foreign explorations than have California citrus growers for abandoning fumigation and spraying for the control of the red scale (*Chrysomphalus aurantii*), purple scale (*Lepidosaphes beckii*), black scale (*Saissetia oleæ*) and the citrus mealy bug (*Pseudococcus citri*) in view of the efforts being made by the State Commission of Horticulture to subdue these leading citrus pests by importations of their natural enemies.

Without going into the details of the history of the importation of the many natural enemies of these scales into California during the past twenty years, it is sufficient to say here that none of the species mentioned is at present controlled to a satisfactory degree by the introduced natural enemies and that the expense of combating these pests in California citrus groves is not materially affected by the introductions. The recognition of this fact does not detract from the true benefits of the work, since the results cannot be measured at present upon such a basis. It seems unlikely that there exists a single species of insect enemy in the case of any of the four pests here referred to which is capable of accomplishing complete and satisfactory control. Combined, certain of the natural enemies may be sufficient but a single minor omission may leave a broad gap between success and failure from a commercial standpoint. It appears to be the present endeavor of the California Commission of Horticulture to supply these omissions.

During the next five years there is as much likelihood of the whitefly problem in the Gulf Coast citrus regions being temporarily disposed of by a freeze equally disastrous in its consequences to those of the winter of 1894–95 as there is likelihood of a general condition of control by natural agencies being brought about during that time. The citrus growers of Florida, Louisiana and Texas have before them the opportunity to profit by the history of the efforts to control citrus pests in California by means of natural enemies and while efforts to bring about a condition of natural control of the whiteflies should be increased rather than diminished, no time should be lost on account of such efforts in placing the control of these insects upon an organized business basis and in insuring against the further importation and establishment of undesirable insects.

LEAKAGE OF FUMIGATION TENTS

By C. W. Woodworth

The purpose of the present paper is the discussion of the significance of the leakage factor in fumigation and the development of a dosage system which shall be based upon the varying conditions of leakage tents found in actual operation in the field.

Every one unacquainted with the facts regarding the conditions under which fumigation is carried on will be inclined to enquire, "Why have any leakage at all?" No doubt there can be and should be much improvement in this respect but under the best conditions likely to be obtained, this factor will still remain a very important element in calculating the dose to be used.

The practice of fumigation has been developed without scientific supervision and the dose given to trees of varying sizes was determined by "cut and try" methods and the actual system used as a result of practical experience of hundreds of fumigators developed through a quarter of a century of practical work is entirely at variance with the suggestions of the scientific men who first developed the method.

Many present, perhaps, do not appreciate that fumigation is not only the most important insecticide operation in California as measured by its cost, but also that it is more important than the combined insecticide work of any other state or of any foreign country.

The development of the process to such proportions, amounting to an outlay of now about $500,000 per year, could only have occurred where the average practice has become approximately correct.

The first attempt to develop a system for the calculation of the dose consistent with the practice of fumigation was in 1903.[1] At that time there was no data in existence for dose calculation corresponding even approximately with the practice, and the scheduling of orchards was exclusively by the judgment of the fumigator, acquired by observing the work of the other fumigators and corrected from time to time by results obtained in fumigation.

Under such conditions there was bound to be much irregularity in individual cases even though the average results were certainly very dependable.

Several thousand measurements were made at that time showing that the average dose of four ounces corresponded with an average ten-foot tree; a dose consistently used by no fumigator but nevertheless that established, and firmly established, by practice for the destruction of the black scale.

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[1] Bulletin No. 152, California Experiment Station.

This dose may be considered as ample or perhaps a little high, for the reason that it represents the average of all fumigation work though some of it (not a very large amount, however) was for red and purple scale work, both of which usually receive more than the black scale, and because fumigators would be more liable to give more than necessary since a slight injury to the tree is not considered as bad as a failure to kill the scale.

The measurements also gave data showing that the rate of increase of dose for larger trees and of decrease for smaller ones did not correspond with the changes in volume. While there was a great deal of diversity in the practice of different fumigators, they agreed in the one fact that the rate of change in dose was strikingly less than the rate of change in volume.

The suggestion made at that time based on the results of this study was that the area of the surface of the tent instead of the volume enclosed might be adopted as the measure of the dose. This suggestion has been followed by several writers and experimentors and is today the only basis of calculation that approximates the actual average practice.

At the time the above suggestion was made, it was clearly understood that the area basis of calculation gave only an approximation to the correct dose and did not by any means represent an accurate allowance for any particular degree of leakage. A recent student (Woglum) has offered a table calculated by the formula dose $= v \times \frac{a}{v}$ which he supposed did accurately allow for leakage but of course is only the area basis suggested by me years before.

Last year in presenting the methods available for scheduling trees for fumigation, the need of some method of measuring the leakage of tents and of accurately adjusting the dose to the leakage became very evident. Accordingly the present season over 5,000 determinations were made in the field of the leakage of fumigation tents in actual operation and in many cases of the same tent under varying weather conditions. The details of these results cannot be given at this time and we shall limit ourselves to the one problem of the application of the averages thus obtained to the production of a table of dosages.

Of course such a table must be taken as only an approximation but there seems to be sufficient data at hand to warrant us in considering this table accurate enough for practical use.

The other problems concerned are now the subject of investigation and will be presented in due time.

In the absence of accurate experimental data relative to the laws governing the escape of gases through such a net work as presented by the weave of a fumigation tent, we are forced to the assumption that

the gas follows the laws of diffusion to the extent that the rate of escape is directly proportional to the differences in density. All the data at present at hand accords with the assumption with the limits involved; it is probably a very close approximation to the facts.

The *amount* of *leakage* may be stated in terms of percentage of the area of the surface; this is readily determined by finding the area of an orifice which will permit the flow of air at the same rate as through a portion of the canvas tested. The ratio of these two areas gives the percentage of leakage. For practical purposes it is better to determine the leakage of a doubled canvas and use this figure since when this is done one can easily make determinations at any part of the tent. The average leakage of doubled fumigation tents is .25% and the common range from .1% to .4% depends on the character of the canvas and on variations in weather conditions.

The *density of the gas* depends upon the relation of the dose to the volume of the tent. According to the universal practice of fumigators, the density used will be greater in small tents and less in large tents. If the dose were made exactly proportional to the area then the density would be represented by the ratio $\frac{a}{v}$ and be therefore inversely proportional to the diameters in trees of similar shapes. Thus it will be seen that while the area basis of scheduling may give a rough approximation of the dosage of the average leakage .25%, it will clearly not apply even roughly to tents showing any other per cent of leakage.

The *effect of leakage* upon the density in a small tent is greater than in a large tent because each unit of surface covers less average depth of gas; the quantity escaping per minute depending upon the density. It is evident that if a gram escape from each unit of surface the first minute from each of two tents, the remaining gas is a larger percentage of the original amount in the case of the larger tent. The volume behind each unit of surface of tent is indicated by the ratio $\frac{v}{a}$ and for tents of uniform shape is directly proportional to the diameters.

Stated in other words the time required to reduce the gas to 50% of its original strength is twice as long in the case of a tree 20 ft. in diameter as would be required for a tree 10 ft. in diameter when each is covered with a tent showing the same percentage of leakage.

The *per cent of leakage* determines the time required to reduce the density to any given percentage. Very evidently the size of the orifice in the escape either of a liquid or of a gas determines the rate of escape. Two openings will cause it to pass out in half the time and so will one orifice with twice the effective area. The density of the gas in a tent of .2% leakage will require twice as long to drop to 50% as it would in the same sized tent having .4% leakage.

The *time required to kill* will be somewhat dependent upon the density of the gas. Years ago thirty minutes were employed for fumigation but all fumigators now use forty to fifty minutes. One of the investigations now under way is the determining of the killing strength of gas for different times of exposure.

We do not know when the maximum density of gas is obtained in the generation which sometimes takes as much as fifteen minutes; it is probable that a greater or less time elapses after the killing has been accomplished before the tents are actually removed. Under average conditions the present period may be considered justified. When we have sufficient data we may be able to reduce the time in certain cases and advise the extending of it in others. For the present, however, we must accept the time and suppose that the dose of four ounces for a ten-foot tree maintains the killing strength of gas for the necessary period under the average conditions of leakage and it is not necessary to know exactly what this period is.

To calculate the dose for trees of different size and for tents of different leakage we need but to know that the above dose applies to .25% leakage for a 10 ft. tree and that in the case of other trees the ratio of increase or decrease of dose corresponds approximately with the area, that is, when the volumes are in the ratio of 1:8, the dose is in the ratio of 1:4.

The correct dose for a tent consists of two factors, (1) the theoretical amount necessary to kill when the tent is tight; (2) the amount of increase to allow for leakage. When one tent has twice the diameter of another, provided they are of the same shape, they have the ratio 1:8 in volume and if 1 is the theoretical dose of the smaller, 8 is the theoretical dose of the other. The second factor for these two tents consists of numbers, one the square root of the other. If half the gas escapes in ten minutes, half of the remainder will have escaped at the end of twenty minutes. Now with a tent of twice the diameter the loss in twenty minutes will only be that occurring in the smaller tent in ten minutes. The dose to compensate for the losses in these two tents during twenty minutes would require in one case a doubling and in the other case a fourfold increase. The ratio between these two rates of increase is that one is the square root of the other.

The formula would be

$$\text{dose } d^3 \times \sqrt[d]{1}$$

in which d = diameter and 1 = leakage factor.

Our unit diameter is 10 ft. and the leakage factor that satisfies the condition of the average dosage practice is four as shown by the following calculation:

	10 ft.	20 ft.
Theoretical	1 oz.	——
Leakage factor	4 oz.	$2^3=8$
	——	$\sqrt[3]{4}=2$
Product = dose	4	——
		16

Since the amount of leakage has precisely the same effect on the leakage factor as the size of tent the formula becomes

$$\text{dose} = d^3 \times \sqrt[p]{1}$$

in which p = per cent of leakage with .25 as the unit.

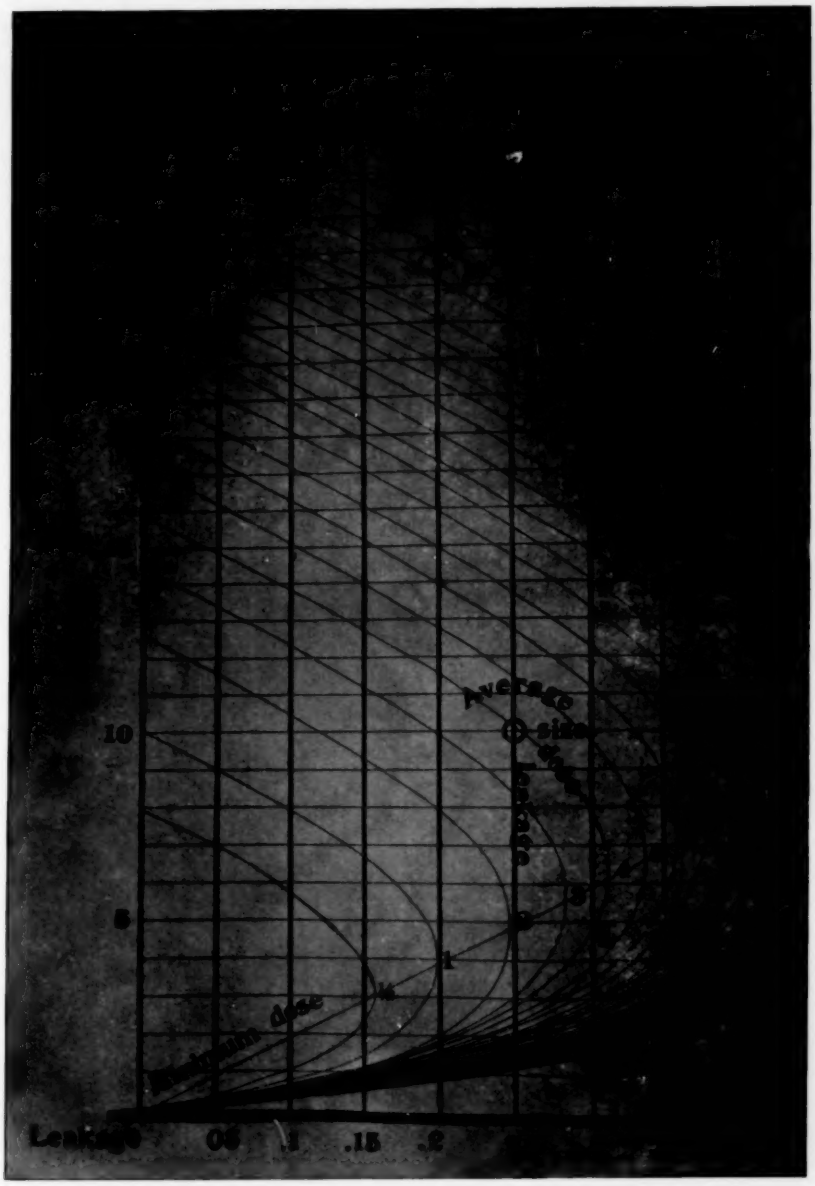
Applying this formula tables were calculated for the dose corresponding to the size of the tree and the degrees of leakage indicated by the straight lines of the chart and the curves indicating the dosages were drawn in accordance with these calculations.

The table is based as already indicated upon the actual practice of fumigators as regards the dose for a 10 ft. tree with average leakage. The portions of the table nearest this average therefore can be looked upon as having an accuracy independent of the calculations.

The most probable error is in the determination of 4 as the leakage factor; 4 is right if 16 oz. is right for a 20 ft. tree but most fumigators in fact give a 20 ft. tree less than 16 oz. which would indicate a larger factor. In case the leakage factor should be more than 4, the result would be the slight widening of all the curves, making still more pronounced the difference between the dosage of the tight and leaky tents of the same size.

It seems safe to say that the importance of leakage is not less than that indicated by the chart.

Of recent years there has been a very general appreciation of the necessity of measuring the sizes of trees when scheduling. There is no doubt that grave mistakes are made where measuring is not done but no matter how accurate one may be in the measuring of a tree, this chart shows that the fumigator may make the dose only a quarter as large as it should be or three or four times as great as is necessary in case the tents are leaky or tight. No mistakes anywhere near as large as these were found in all of the thousands of measurements made by us to test the relation of dosage to size of tree. We are led to conclude, therefore, that it is very much more important to measure the leakage than to measure the size.



Fumigation dosage for black scale based on size of tent and leakage of gas

PLANT LOUSE NOTES, FAMILY APHIDIDÆ

(*Concluded*), Plate 16

By C. P. GILLETTE

Rhopalosiphum rhois Monell.—This species was taken on sumac (*Rhus* sp.) on Belle-Isle, Detroit, and at Fort Lee, and was extremely abundant on wild sumac about Georgetown, D. C. At the latter place the sumacs had been so severely attacked that much of the foliage had the appearance of having been frosted, and many of the leaflets had fallen. The third joint of the antenna has from five to eight slightly raised sensoria in the specimens collected. The antenna and cornicle of the summer winged form are shown in figures 1 and 1a.

Rhopalosiphum capreæ Fab.—This species was taken at Amherst and Webster, Mass., and at Fort Collins, Col. It has the willows (*Salix* species) for its winter hosts and several species of Umbelliferæ for its summer food plants. For illustrations and fuller notes on this species and *R. pastinacea* see an article by the writer in the June, 1911, number of the JOURNAL.

Amphorophora rubi (Kalt.)
Aphis rubi, Kaltenbach, Walker.
Siphocorine rubi, Koch.
Siphonophora rubi, Buckton.
Amphorophora rubi, Schouteden.

The above seems to be the synonomy of this species. Examples were taken by Mr. Bragg at Webster, Mass., on *Rubus occidentalis*. It was also taken on the same host plant at Fort Collins, Col., July 7–31, 1908. The hind legs are very long, the tibiæ being nearly as long as antennal joints 3, 4, 5, and 6 together. For antenna and cornicle of alate summer form see figures 2, 2a and 3. These specimens from Massachusetts agree with specimens of this species from *Rubus fruticosus* at Southwater, Sussex, England, July 2, 1909, collected and sent to me by Prof. T. D. A. Cockerell, except that the specimens from Europe are a little smaller.

A very similar species taken by Mr. Bragg at Lawrence, Kans., differs by having cornicles decidedly shorter and having joint 4 of the antenna in the alate viviparæ well set with sensoria.

Myzus cerasi Fab.—Taken at Portland, Mich., Rochester and Albany, N. Y., and Portland, Hood River and Corvallis, Ore., on *Prunus cerasus;* at Webster, Mass., on *P. serotina*, and on *Prunus emarginata*, var. *mollis*, at Portland, Ore. This species is abundant on the eastern slope, and occurs in a few localities only on the western slope

in Colorado on both the sweet and sour cherries. It breeds very rapidly early in the season, often nearly covering the foliage and greatly injuring the crop. Figures 4 and 4a show the antenna and cornicle of the alate viviparous female.

Myzus ribis Linn.—This species was taken at Chicago and at Webster, Mass., on the garden currant, *Ribes rubrum*. Fairly common but not abundant about Fort Collins and Denver. Readily recognized by its small size, yellow color, and the puffed red blisters of the upper surface of the currant leaves caused by the punctures of the lice upon the under surface. Figures 5 and 5a show the antenna and cornicle of alate viviparous female taken at Fort Collins, 7–9– '07.

Myzus rosarum Walk.—Abundant on rose bushes in Detroit and Portland, Ore. An extremely abundant species on roses in Fort Collins, often ruining the flowers, or even the buds before they open. Especially bad on the climbers. The antenna of the alate viviparous form taken at Fort Collins, 6–10– '09, is shown at figure 6, the cornicle at 6a. The hind tibia of an oviparous female is shown at figure 7 and the cornicle at 7a. The last was taken from rose at Fort Collins, November 5, 1909. We have also taken this species upon cultivated strawberry and upon *Potentilla* sp. Several males and females have been taken on all the above.

Myzus persicæ Sulz.[1].—This louse was only noted at Webster on garden vegetables, though it is probably common through most of the states traversed. It is abundant every year in Colorado. The peach and plum are the chief fall, winter and spring hosts, though a considerable proportion of the fall lice remain viviparous and hibernate on various herbaceous plants out of doors and upon various greenhouse plants, notably the snapdragons and the carnations indoors. See illustrations in Plate 6, of JOURNAL OF ECONOMIC ENTOMOLOGY, October, 1908.

Phorodon humuli Sch.—Taken on hop vines at Detroit and at Webster. This louse is fairly common on both eastern and western slopes in Colorado and we have known it to remain on the plum in small numbers throughout the summer. I have never seen it injuriously abundant on the plum in this state. Specimens from Sussex, Eng., sent by Professor Cockerell, seem in every way like our American examples. The antenna and cornicle of the alate summer form are shown in figures 8 and 8a.

Macrosiphum tanaceti Linn.—Taken at Webster, Mass., and Kansas City by Mr. Bragg from *Tanacetum vulgare;* very abundant. The entirely black antennæ, cornicles, cauda and legs; the straight,

[1]For illustrations of this species see Bulletin 133 Col. Exp. Sta. or JOURNAL OF ECONOMIC ENTOMOLOGY, 1908. p. 359.

slightly tapering and moderately long cornicle, and the reddish brown abdomen are characteristic of this species. A very similar but apparently distinct species occurs on *Artemisia ludoviciana* in northern Colorado. See figures 9 and 9a.

Macrosiphum tulipæ Monell.—A very common louse where the tulip tree, *L. tulipifera*, was seen at Lansing, Fort Lee, Washington, D. C., Kansas City, Amherst and Webster. Figures 10 and 10a.

Macrosiphum rudbeckiæ Fitch.—Taken on golden glow at Detroit and Webster. This is a very common species on *Rudbeckia*, both wild and cultivated, on both slopes of the mountains in Colorado. We have taken it upon *Solidago* in a few instances. The shorter cornicles alone will separate the fall adults from those of *solidaginis*. See figures 11, 11a, and 12.

Macrosiphum sonchi Linn.—What I believe to be this species was taken on *Sonchus* at Webster, Mass., and at Washington, D. C. Notice the remarkably long third joint and flagellum of the antenna. A great deal of collecting from *Sonchus* in Colorado has not given this species. Figures 13 and 13a.

Macrosiphum erigeronensis Thos.—Taken at Fort Lee on *Erigeron* sp. The species is also fairly common at Fort Collins on *Erigeron canadense*. There seems to be considerable variation in the length of the antennæ between the New Jersey and the Colorado species, the former being the shorter. The drawings, figures 14, 14a and 15 are from an alate viviparous female taken July 26 at Fort Collins. There may be two species involved.

Macrosiphum rosæ Linn.—Taken at Chicago, Lansing, Detroit, Webster and Wood's Hole, and in both green and pink forms on wild roses at Portland, Ore. Appears to be common wherever roses are grown. This is a common species on both the eastern and western slopes in Colorado. Taken in both colors, green and red. Figures 16, 16a and 17.

Macrosiphum solidaginis Fab.—Taken on *Solidago* at Washington, Webster and Portland, Ore., and on *Aster* sp. at Albany and Portland, Ore. This is a common species on *Solidago* about Fort Collins and Denver. See figures 18 and 18a.

Macrosiphum liriodendri Monell.—Taken on leaves of *Liriodendron tulipifera* at Washington, agree with specimens of the same species in the collection taken by Mr. J. T. Monell at St. Louis, Mo., and others by Mr. J. J. Davis taken at Urbana, Ill. An apterous oviparous female from Davis has the hind tibiæ well covered with sensoria (?) in proximal two thirds. The males are winged. See figures 19, 19a, 20 and 21.

Macrosiphum pisi Kalt.—Taken from *Trifolium pratense* at

Plate 16

Structure of Aphididæ

Albany, N. Y., July 1. I also have specimens from Maryland sent me by Prof. W. G. Johnson. The specimens were taken by him from garden pea, *Pisum sativum*. This is a very abundant species in Colorado on both eastern and western slopes where we have taken it from the garden pea, *Lathyrus odoratus*, alfalfa, *Medicago sativa;* and sweet clover, *Melilotus alba*. The examples taken from these plants seem identical with specimens sent in by Professor Cockerell that were taken from pea vines in Sussex, Eng., July 4, 1909. This species has remarkably slender cornicles; the antenna is ringed with black at the distal ends of joints 3, 4 and 5, and in the apterous viviparous female there are from two to five small sensoria near the base of the third joint. See figures 22, 22a, 23 and 24. The drawings are from the European specimens.

Macrosiphum ambrosiæ Thos.—Taken at Lawrence, Kans., only. This is a very abundant louse about Fort Collins every year and especially on *Ambrosia trifida*. We have also taken it on *Rudbeckia*, and *Iva xanthifolia*. See figures 25 and 25a.

Macrosiphum sanborni Gillette.—Taken on chrysanthemums growing out of doors at Hood River, Ore. This louse is common and often quite destructive to chrysanthemums in greenhouses in Colorado. Figures 26 and 26a.

Plate 16. The following figures of antennæ, cornicles and tibiæ of Aphididæ are from the winged viviparous forms unless otherwise designated: 1 and 1a, *Rhopalosiphum rhois;* 2 and 2a, *Amphorophora rubi*; 3, third antennal joint of apterous female of same; 4 and 4a, *Myzus cerasi;* 5 and 5a, *Myzus ribis;* 6 and 6a, *Myzus rosarum;* 7 and 7a, hind tibia and cornicle of oviparous female of same; 8 and 8a, *Phorodon humuli;* 9 and 9a *Macrosiphum tanaceti;* 10 and 10a, *Mac. tulipæ;* 11 and 11a, *Mac. rudbeckiae;* 12, third joint of antenna of apterous form; 13 and 13a, *Mac. sonchi;* 14 and 14a, *Mac. erigeronensis;* 15, the third joint of antenna of apterous form; 16 and 16a, *Mac. rosæ;* 17, third antennal joint of apterous form; 18 and 18a, *Mac. solidaginis;* 19 and 19a, *Mac. liriodendri;* 20, male; 21, hind tibia of oviparous female of the preceding; 22 and 22a, *Mac. pisi;* 23 and 24, antenna and cornicle of oviparous female of the preceding; 25 and 25a, *Mac. ambrosiæ;* 26 and 26a, *Mac. sanborni.*

The amplification is indicated with each figure. Original, M. A. Palmer, Delineator.

AN ANNOTATED LIST OF THE LITERATURE ON INSECTS AND DISEASE FOR THE YEAR 1910

By R. W. Doane, *Stanford University*

While the year 1910 gave us no positive new discoveries in regard to the relation of insects to disease, it nevertheless marked important advances in the study of several diseases dependent on insects for dissemination.

As during 1909, greatest interest centered around the studies in regard to Sleeping Sickness. Following Thimm's Bibliography of Sleeping Sickness, published late in 1909, is his subject index to this bibliography, which is a great help to any one studying the subject. The monthly list of publications given in the bulletins of the Sleeping Sickness Bureau contains more than four hundred references to papers and reports published on this subject in 1910. Many of these deal with the method of transmission of the trypanosome and its development in the tsetse fly. It is now believed that mechanical transmission of the parasite rarely, if ever, occurs, and it has been definitely shown that the trypanosome undergoes a development in the tsetse fly lasting from eighteen to thirty-four days.

Doctor Sambon's investigations on the cause of pellagra, and the announcement that he finds that it is transmitted by a *Simulium*, have excited a great deal of interest and comment. For some time Doctor Sambon has held that there is a definite relation between the disease and these flies. As a result of last season's investigations in Italy he believes that he has collected abundant evidence to prove that these flies are responsible for the dissemination of the disease. The Italian government has been the first to take any definite steps toward testing this theory, and has appointed a commission to examine the evidence and to formulate any changes in the existing laws that it may be deemed advisable to make on account of the advances in our knowledge of the disease. American physicians are slow to accept this theory. At least they are waiting to be shown that the flies and the disease always go together in this country, as Sambon claims that they do in Italy. It will take most conclusive evidence to establish this new theory in the minds of those who have been working so long on the relation of maize to the disease. The present year should see much work done on this problem in America.

The death of Dr. Howard T. Ricketts in Mexico marks the passing of one of the most promising investigators in the field of preventive medicine. Although still a young man he had already accomplished much. It is principally to him that we owe our knowledge of the

relation of ticks to spotted fever. For some time before his death he had been working on the possible relation of insects to typhus fever. It was while carrying on these studies that he contracted the disease which ended fatally. But he had succeeded in gathering much valuable data, and his experiments, taken with those of others, leave little room for doubt that the common body louse (*Pediculus vestimenti*) is responsible for the transmission of the disease.

"The Prevention of Malaria," by Doctor Ross and others, is one of the most important additions to our literature in regard to the relation of mosquitoes to disease. Doctor Howard in his "Preventive and Remedial Work against Mosquitoes" sums up our present knowledge in regard to the subject treated in the bulletin. It is to be noted that in this publication the well-known *Stegomyia calopus* masks under the name *Aedes calopus*. Most workers will be more content to accept Theobald's decision and go back to the old name *Stegomyia fasciata*. Part five of Theobald's "Monograph of the Culicidæ of the World" is a most important contribution to the systemic literature of this family.

Early in November press dispatches announced that the first case of yellow fever had appeared in Hawaii. A sailor on one of the Japanese cruisers that had just arrived from Mexico was found to have the disease and the ship was held in quarantine. The utmost vigilance will be necessary to keep this disease out of these and the other tropical islands of the Pacific.

Much has been written about the relation of flies to typhoid fever and other diseases but with the exception of Doctor Currie's report on the relation of flies to leprosy, but little new evidence has been brought forth.

Several important articles on fleas and plague have appeared in various journals and reports. Mitzmain's papers have given us many interesting facts in regard to the bionomics of the flea. McCoy and others have shown the close relation existing between the rats and the ground squirrels. Bulletin 30 of the Pub. Health and Marine Hospt. Service on "The Rat and its Relation to the Public Health," contains several important articles.

The "Bulletin of Entomological Research," the first number of which appeared early in 1910, promises to be of particular interest to workers along this line. It is issued by the Entomological Research Committee (Tropical Africa) appointed by the Colonial office. The committee is composed of several prominent workers in tropical medicine and entomology. Besides several articles relating to various phases of tropical entomology there are many shorter articles and notes that often contain valuable bits of information.

The following list makes no claim to completeness, but is believed to include most of the English and American publications. Only a few of the Continental papers are included. It may serve as a supplement to the bibliography given in my "Insects and Disease."

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Wakeling, T. G. Fever caused by the bite of the sand-fly. Brit. Med. Jour., October 15, 1910. Describes the effect of the bite and the illness that later results.

Tracoma

Eaton, F. B. The etiology, prevention, treatment, and cure of tracoma. Opthalmic Record, August, 1910. This is a fuller report on his theory (published in same Journal, September, 1908), that horse-flies are responsible for the transmission of this disease.

Tsetse Flies, Trypanosomes, and Sleeping Sickness

(For a full list of references to these subjects see the Bull. of the Sleeping Sickness Bu. Only a few can be given here.)

Bagshawe, A. G. *Glossina palpalis:* a résumé. Sleep. Sick. Bu. Bull. no. 14, February, 1910. A summary of the observations made since the publication of the article on the same fly in Bull. no. 3, January, 1909. Notes on life-history, habits, etc.

Bagshawe, A. G. The transmission in nature of *Trypanosoma gambiense*. Sleep. Sick. Bu. Bull., 18, June, 1910. Considers it not improbable that species of *Glossina* other than *palpalis* may transmit this trypanosome.

Bagshawe, A. G. Sleeping Sickness in Whites. Sleep. Sick. Bu. Bull., 20, September, 1910. Gives records of fifty cases of sleeping sickness in Europeans.

Bagshawe, A. G. Recent advances in our knowledge of sleeping sickness. The Lancet, October 29, 1910: Trans. Soc. Trop. Med. & Hyg., November, 1910. Jour. Trop. Med. Hyg., November 15, 1910.

Bruce, D. Human Trypanosomiasis. Brit. Med. Jour., September 24, 1910.

Chagas, C. Uber eine neue Trypanosomiasis des Menschen. Memoriasis do Instituto Oswaldo Cruz., Rio Janerio, Vol. 1, 1909. A disease similar to sleeping sickness thought to be transmitted by Reduviid bugs, especially *Conorhinus megistus* Brum. A small monkey is thought to be the reservoir of the virus.

Low, G. C. The transmission in nature of *Trypanosoma gambiense*. Jour. Trop. Med. & Hyg., July 15, 1910.

Minchin, E. A. and **Thomas, D.** Transmission of *Trypanosoma lewisi* by rat fleas. Proc. Roy. Soc. series B, 82 (1910), p. 273–285. Show that *C. fasciatus* can transmit *T. lewisi* from infected to non-infected rats. Transmission not direct, but parasite must undergo a development of six or seven days in the flea.

Swellengrebel, N. H. and **Strickland, C.** The development of *Trypanosoma lewisi* outside of the vertebrate. Parasit., September, 1910. Experiments show that it develops normally in *Ceratopsyllus fasciatus;* irregularly or incompletely in the rat louse or bedbug, and not at all in the tick (*O. moubata*).

Strickland, C. and **Swellengrebel, N. H.** Notes on *Trypanosoma lewisi* and its relation to certain Arthropoda. Parasit., December, 1910. Fleas, lice, bugs, ticks and mites were experimented with but the parasite was transmitted only by the flea.

Thimm, C. A. Subject index to the bibliography of trypanosomiasis. Pub. by the Sleeping Sickness Bureau, 1910.

The Sleeping Sickness Commission of the Royal Society, composed of David A. Bruce, A. E. Hamerton, H. R. Bateman, and F. P. Mackie, published the following papers in the Proc. of the Royal Soc. series B, vol. 82, 1910:

Amakebe: A disease of calves in Uganda, p. 256–272. This disease of calves corresponds to East Coast Fever of adult cattle and is carried in the same way by *Rhipicephalus appendiculatus* (brown tick), *R. evertsi* (red-legged tick), and *R. simus*, all common in Uganda.

The development of trypanosomes in tsetse flies, p. 368–388. Show that *T. gambiense* and other species multiply in the gut of *Glossina palpalis* and the flies become infective, on an average, thirty-four days after their first feed, and may remain infective for seventy-five days.

Trypanosome diseases of domestic animals in Uganda. 1. *Trypanosoma pecorum*, p. 468–479. This parasite causes an important disease of cattle and is probably carried by a *Tabanus* and not by *Stomoxys*.

Experiments to ascertain if cattle may act as a reservoir of the virus of Sleeping Sickness, p. 480–484. Experiments proved that they may do so. Healthy animals may be infected from them by means of *Glossina palpalis*. Cattle in the fly area naturally harbor *T. gambiense* and it is therefore possible that cattle and antelope may keep up the infectivity of the fly for an indefinite period. Up to the present time there is no proof that this actually takes place in nature.

"Muhinyo," a disease of natives in Uganda, p. 485–490. This is Malta Fever and is conveyed from the goat to man by the drinking of the goat's milk.

The natural food of *Glossina palpalis*, p. 490–497. In the first series 27 per cent of the flies had fed on blood, the majority of which was of mammalian origin. In the second series nearly 60 per cent contained the remains of a blood meal mostly from birds or reptiles.

Mechanical transmission of Sleeping Sickness by the tsetse fly, p. 498–501. Mechanical transmission can take place if the transference is instantaneous—that is by interrupted feeding—but not if an interval of time comes between the

feedings. Mechanical transmission plays a much smaller part, if any, in the spread of Sleeping Sickness than has been supposed.

In the first number of vol. 83 are two more papers on trypanosome diseases of domestic animals in Uganda.

Rats and Squirrels and Plague

Blue, Rupert. Rodents in relation to the transmission of bubonic plague. Pub. Health & Mar. Hospt. Ser. Bull., 30, 1910. Epidemilogical observations, ground squirrel infection, etc. References.

Converse, G. M. Intimate association of rats and ground squirrels. Pub. Health Rep. 25, no. 19, May 13, 1910. Finds rats and squirrels occupying the same holes and hiding under the same barns. Took rat fleas from squirrels.

King, W. G. Plague and the destruction of rats. Jour. Royal Inst. of Pub. Health, December, 1910. Discusses the recent outbreak in Suffolk and methods of fighting rats.

Lantz, D. E. Natural history of the rat. Pub. Health & Mar. Hospt. Ser. Bull. 30, 1910. Classification, distribution, habits, etc.

McCoy, G. W. Plague among ground squirrels in America. Jour. of Hyg., December, 1910. A review and a good summing up of the plague situation in California.

McCoy, G. W. The evidence of plague infection among ground squirrels. Pub. Health Rept. 25, no. 2, January 14, 1910. Considers it conclusive that the disease among ground squirrels is caused by the same organism that causes plague among humans and rats.

McCoy, G. W. Antiplague measures in California. Pub. Health Rep. 25, no. 18, May 6, 1910. Tells of the work being done to exterminate rats and squirrels.

McCoy, G. W. Plague infection in Rats. Pub. Health & Mar. Hospt. Ser. Bull. 30, 1910. Mode of examination, characteristics, lesions, artificial infection, etc. References.

McCoy, G. W. Plague infection in a bush rat. (*Neotoma fuscipes.*) Jour. Infec. Diseases, 7 (1910), no. 3, p. 368–373. This rat found to be infected.

McCoy, G. W. Bubonic plague in ground squirrels. N. Y. Med. Jour., October 1, 1910.

McCoy, G. W. and **Smith, F. C.** The susceptibility to plague of the prairie dog, the desert wood rat, and the rock squirrel. Jour. Infec. Diseases 7 (1910), no. 3, p. 374–376. Rock squirrels readily infected; evidence not sufficient in other cases, but they appear to be susceptible.

McLaughlin. The menace of plague in ground squirrels. Bull. Cal. St. Bd. Health, October, 1910. A review of the cases of plague due to ground squirrel infection. Points out the dangers from leaving infected squirrels in a locality.

Petrie, G. F. Rats and plague. Nature, November 3, 1910. A short article showing the relation of these.

Rucker, W. C. Note on plague infection in a wood rat (*Neotoma fuscipes*). Pub. Health Rep. 25, no. 1, January 7, 1910.

Rucker, W. C. Field operations against the squirrel plague in California. N. Y. Med. Jour., June 18, 1910.

Rucker, W. C. Rodent extermination. Pub. Health & Mar. Hospt. Ser. Bull. 30, 1910. Trapping, poisoning, natural enemies, etc.

Simpson, F. Plague as a rural problem. Bull. Cal. St. Bd. Health, October, 1910. Points out that a region where infected squirrels occur is safe only when they are exterminated.

Stiles, C. W. and **Crane, C. G.** Internal parasites of rats and mice and their relation to diseases of man. Pub. Health & Mar. Hospt. Ser. Bull. 30, 1910.

Stiles, C. W. and **Hassall, A.** Compendium of animal parasites reported for rats and mice. Pub. Health & Mar. Hospt. Ser. Bull. 30, 1910.

Walker, E. A. Transmission of plague in the absence of rats and rat fleas. Indian Medical Gazett, March, 1910.

Reports on Plague Investigations in India. Issued by the Advisory Committee. Jour. of Hyg., November, 1910 (Fifth extra plague number). Among other articles the following refer especially to the relation of rats and fleas to the disease: "The experimental production of plague epidemics among animals." Further experiments which show that the plague spreads rapidly among rats when fleas are present. "Interim report of the Advisory Committee for plague investigations in India." A summary of the conclusions reached. They believe that "in the great majority of cases during an epidemic of plague man contracts the disease from plague-infected rats through the agency of plague-infected rat fleas."

The two articles on observations on rat and human plague in Belgium and Poona, especially the latter, show the very close relation of the prevalence of rat fleas to the number of cases of plague.

The rat and its relation to the public health. By various authors. Pub. Health & Mar. Hospt. Ser. Bull. 30, 1910. (No number is is given on the bulletin but it is listed as no. 30 in the list of publications.) Contains articles in regard to the rat, its parasites and its relation to plague, etc. Some of these articles are listed in this and the following section of this list.

Plague in England. Ed. in Jour. Amer. Med. Assn., November 19, 1910. Refers to recent outbreak of plague in Suffolk, Eng.; four deaths; rats and hares found infected; immediate efforts to get rid of these and clean up; work done so quickly and quietly that the public hardly knew about it.

Fleas and Plague

Banks, N. Ectoparasites of fleas. Pub. Health & Mar. Hospt. Ser. Bull. 30, 1910. Describes and gives tables for the identification of fleas, lice and mites.

Fox, Carroll. The flea and its relation to plague. Pub. Health & Mar. Hospt. Ser. Bull. 30, 1910. Among other things author discusses anatomy and habits of the fleas and gives descriptions of the common forms. References.

McCoy, G. W. A note on squirrel fleas as plague carriers. Pub. Health Repts. 25, no. 15, April 15, 1910. *Ceratopsyllus acutus*, the ground squirrel flea, transmitted plague from ground squirrels to guinea pigs and from squirrel to squirrel.

McCoy, G. W. Fleas as plague carriers between rats and ground squirrels. Pub. Health Repts. 25, no. 20, May 20, 1910. *C. acutus* can transmit plague from ground squirrels to white rats and *C. fasciatus* can transmit the disease from rats to ground squirrels.

McCoy, G. W. Fleas collected from squirrels from various parts of California. Pub. Health Repts. 25, no. 21, June 3, 1910. Records six species: *C. acutus; H. anomalus; Ct. musculi; A. gallinacea; H. affinis; Sp. inæqualis.*

Mitzmain, M. B. A parasitic and a predatory enemy of the flea. Pub. Health Repts. 25, no. 13, April 1, 1910. A new tyroglyphid mite, *Histiostoma tarsalis* found on *C. acutus, C. fasciatus,* and *L. cheopis.* A beetle (*Staphylinus* sp.) has been found to destroy rat and squirrel fleas; seems to be quite efficient.

Mitzmain, M. B. Notes on agents used for flea destruction. Pub. Health Repts. 25, no. 30, July 29, 1910. Water no value; glycerine no value; formalin, phenol, mercuric chloride, and trikresol in strengths used as disinfectants of little value. Powdered sulphur of no value; kerosene and miscible oil extremely efficient; the

fumigants bisulfide of carbon, hydrocyanic acid gas and sulphur dioxid are highly efficient.

Mitzmain, M. B. Some new facts on the bionomics of the California rodent fleas. Annals Ento. Soc. Amer. 3, p. 61–82, 1910. Relation to environment, locomotion, copulation, reaction to light, length of life, feeding, relation to plague.

Mitzmain, M. B. General observations on the bionomics of the rodent and human fleas. Pub. Health & Mar. Hospt. Ser. Bull. 38, 1910. Much the same data as presented in the last reference.

Rothschild, M. C. A synopsis of the fleas found on *Mus norwegicus*, *M. rattus alexanderinus*, and *M. musculis*. Bull. Ento. Research, Vol. 1, pt. 2, July, 1910.

Bedbugs

Girault, A. A. Preliminary studies on the biology of the bedbug (*Cimex lectularius*) 1. The effect of quantitatively controlled food supply on development. Jour. Eco. Biol., October, 1910. Reduced quantity of food did not affect reproduction or sex but lengthened the cycle indefinitely, reduced the size and increased the number of ecdyses.

Survival of bedbugs. A note in Jour. Amer. Med. Assn., June 11, 1910, refers to an experiment made by Dr. W. Hapgood in which he kept the bugs in a bottle without food for nearly six months.

Lice

Anderson, J. F. and **Goldberg, J.** On the infectivity of tabardillo or Mexican typhus for monkeys and studies on its mode of transmission. Pub. Health Repts. 25, no. 7, February 18, 1910. Believe that the body louse (*Pediculus vestimenti*) is the insect that transmits the disease.

Anderson, J. F. and **Goldberg, J.** Etiology of tabardillo or Mexican typhus; an experimental investigation. Jour. Med. Research, June, 1910. Disease not contagious, but authors believe that the body louse is responsible for the transmission.

Breinl, A. and **Hindle, E.** Life history of *Trypanosoma lewesi* in the rat louse. An. Trop. Med. & Parasit., March, 1910. Transmits this trypanosome from the infected to healthy rat by means of the rat flea.

Nicolle, C. Experimental research on exanthematous typhus. Ann. Inst. Pasteur. 24, no. 4, April, 1910. Demonstrates that the body louse that infects human beings transmits the disease.

Ricketts, H. T. and **Wilder, R. M.** The typhus fever of Mexico. Jour. Amer. Med. Assn., February 5, 1910. Think typhus not contagious, but transmitted by insects, probably lice.

Ricketts, H. T. and **Wilder, R. M.** The transmission of the typhus fever of Mexico (Tabardillo) by means of the louse (*Pediculus vestimenti.*) Jour. Amer. Med. Assn., April 16, 1910. Details of these experiments and summary of the results. The fever was transmitted from monkey to monkey and from man to the monkey by the louse.

Ricketts, H. T. and **Wilder, R. M.** The etiology of the typhus fever (Tabardillo) of Mexico; a further preliminary report. Jour. Amer. Med. Assn., April 23, 1910. Observations and theoretical considerations of the etiology of the organisms found in the blood.

Ricketts, H. T. and **Wilder, R. M.** Further investigations regarding the etiology of tabardillo, Mexican typhus fever. Jour. Amer. Med. Assn., July 23, 1910.

Sergent, E. and **Foley, H.** Investigations of recurrent fever and the method of its transmission in an Algerian epidemic. Ann. Inst. Pasteur, 24 (1910), no. 5, p. 337–373. *Pediculus vestimenti* may transmit the disease.

Recent studies on typhus fever. Ed. in Jour. Amer. Med. Assn., December 17, 1910. Gives the results of recent investigations.

Mites

Costa, E. Two important parasites of the skin. Jour. Cutaneous Diseases, January, 1910. *Dermatobia noxialis* found in tumefactions of the head. *Sarcopsylla penetrans* found in ulcerations in the regions of the nails of the feet.

Dahl, Fr. Mites in tumors. Centralbl. Bakt. Parsitenk., 53 (1910), p. 524-533. Describes a mite in tumors in human ovary. Discusses question whether this was simply a parasite in the tumors or a part of the cause of them.

Goldberg, Jos. The straw itch (*Dermatitis schambergi*); A disease new to American physicians. Pub. Health Repts., 25, no. 23, June 10, 1910. Described the disease and the mites that cause it. Figures and photographs.

Schamberg, J. T. Grain itch (*Acaro-dermatitis utricarioides*). Study of a new disease in this country. Jour. Cutaneous Diseases, February, 1910.

Webster, F. M. A predaceous and supposedly beneficial mite, *Pediculoides*, becomes noxious to man. Ann. Ento. Soc. Amer. 3, 1910, p. 15–39. (See also Bu. of Ento. Circular 118, 1910, for practically the same article.) Notes on mites attacking men in European countries. Probably *P. ventricosus* now *P. tritici*. Noted first in America as beneficial. Often attacking men handling grain or those sleeping on straw. Remedy: Thresh and burn straw in the field.

Ticks

Leishman, W. B. Mechanism of infection in tick fever and the hereditary transmission of *Spirochæta duttoni* in the tick. Lancet, January 1, 1910.

Stiles, C. W. The taxonomic value of the microscopic structure of the stigmal plates in the tick genus Dermacentor. Hygenic Laboratory, Bull. 62, 1910. Contains table for families and genera and description of species.

Theiler, A. Ticks and tick-borne diseases. Vet. Jour. 66 (1910) No. 416, p. 98–108. (See also Transvall Dept. Agric. Farmers Bull. 63.)

Miscellaneous Articles

Bruce, J. M. Recent progress in medical science. Med. Press & Circular, August 3, 1910.

Gunn, Herbert. The menace of tropical diseases to California. Cal. St. Bd. Health Bull., September, 1910. Relation of San Francisco to the orient and the various diseases that are to be guarded against.

Henshaw, H. W. Ground squirrels and spotted fever. Rept. of Bu. of Biological Survey for 1910. Tells of coöperation with Bu. of Ento. to study the relation of squirrels and ticks to this disease.

Hoff, J. R. Hookworm, malaria, yellow fever and their relation to the health of the American citizen. Woman's Med. Jour., June, 1910.

Marshall, H. T. Animal experimentation in relation to Protozoan tropical diseases. Jour. Amer. Med. Assn., April 23, 1910. Showing how various experiments have enabled investigators to make the recent wonderful advances in preventive medicine. Discusses amebic dysentry, Texas fever, malarial diseases, yellow fever, mosquitoes, sleeping sickness, etc.

McFarland, J. The rôle of Microzoa in the causation and transmission of diseases. Penn. Med. Jour., June, 1910.

Moulton, A. B. History of the progress made in the control of communicable diseases. Penn. Med. Jour., June, 1910.

Müller, R. Arthropods in transmission of disases. Munchener Medizinische Wochenschrift., November 15, 1910. List of insects, spiders, etc., with a discussion of the subject.

Nicolle, C. and **Manceaux, L.** Experimental reproduction of oriental sore in the dog. Compt. Rend. Acad. Sci. 150 (1910), no. 14, p. 889–891. Generally admitted that transmission of this disease takes place through the intermediation of some insect.

Schweitzer, H. Ehrlich's chemotherapy—a new science. Science, December 9, 1910. Tells of the methods of work and some of the results obtained by Erlich and his fellow workers. Refers particularly to trypanosomes and spirochæta and the chemicals used in combatting them.

Smith, A. J. Preventive measures against infectious diseases. Penn. Med. Jour., June, 1910.

Smith, A. J. Infantile paralysis. North American, October 13, 1910. Records discovery of a small Protozoan, resembling the sleeping sickness germ, in the blood of patients suffering from this disease and believes that they may be transmitted by insects.

Smith, J. B. Insects and Entomologists: their relation to the community at large. Pop. Sci. Mo., March and May, 1910. On pages 211 to 218 author discusses the relation of insects to the health of man and domestic animals,

Todd, J. L. Recent advances in our knowledge of tropical diseases. Bull. Johns Hopkins Hospt., July, 1910.

Townsend, E. J. Science and public service. Science, November 4, 1910. Among other things discusses what has been done, what is being done, and what should be done toward controlling infectious diseases.

Wellman, C. Tropical diseases observed in the vicinity of San Francisco. N. Y. Med. Jour., August 13, 1910.

The war against disease. Edinburgh Review, October, 1910. Discusses immunity in infectious diseases and reviews the development of the relation of insects to disease.

Quarantining the house against the diseases of summer. Ed. in World's Work, May, 1910.

INSECTS AND SPIDERS IN SPANISH MOSS

By Arthur H. Rosenfeld, *Tucuman, Argentine Republic*

Of the insect fauna of various sections of the United States, there is, perhaps, less known about that of the swamp than of any other group. This is natural when one considers the comparative isolation of average swamps, the difficulty of collecting in them during a large portion of the year, and the small economic importance to date of an investigation of swamp insects, *per se*. Nevertheless, future investigations of the insects inhabiting the swamps of various portions of the country will very likely throw important light upon the life histories, especially the hibernating habits, of several of our most important economic species.

In the winter of 1908–09, under the direction of Prof. Wilmon Newell, the writer examined a number of lots of the ordinary Spanish moss, *Tillandsia usneoides*, of the Louisiana swamps, in order to

ascertain the number of boll-weevils, *Anthonomus grandis* Boh., passing the winter in this excellent hibernating material. The results of these investigations, so far as the boll-weevil is concerned, have been published by Mr. Newell and Mr. Malcolm Dougherty in Circular 31 of the State Crop Pest Commission of Louisiana.[1] It occurred to the writer at the time that it would be of interest to collect all insects occurring in this moss, as well as all spiders, keeping an accurate record of the number of each species taken, as well as the amount of moss in each lot examined. Notes were also to be kept as to whether the insects found were alive or dead, but it was discovered that all insects taken were alive, this point illustrating, as Messrs. Newell and Dougherty have already pointed out, the excellence of the Spanish moss as hibernating quarters. From the number of insects and spiders taken from each lot of moss it was an easy matter to calculate the approximate number which would occur, in similar proportion, to a ton of the moss from the same location. While these calculations might not always be verified in actual practice, it is more than probable that the figures given represent fairly accurately the conditions as regards habitation of the various insects in the moss at different times, in terms of number of insects per ton. Of course this might not be the case where nests of ants were found in the rotten twigs among the moss, as in the case of *Cremastogaster lineolata* on December 23, 1909. In this case only the adult ants actually taken from the moss were counted.

There can be no doubt that Spanish moss is much sought after by a large number of insects as hibernating quarters, as is evidenced by the much greater number of insects taken from the moss during the winter months than during the warmer month of June. This will also be seen to hold good for the spiders.

Practically all insects taken were in the adult state, unless otherwise noted in the records. During the examinations of the moss, three or four Geometrid larvæ were taken, but were not bred to maturity.

The writer has pondered much over the best method of presenting this data. It was at first thought advisable to average the winter and summer lots of moss, thus reducing the report to two tables, but this was later considered inadvisable on account of the fact that a study of the increase or decrease of the number of several species for the different periods of the year might be of much interest. Hence it has at last been decided to publish the findings of each examination in full, even at the risk of making the tables of undue length. There is given below, therefore, in chronological order, the number of each species of insect and spider collected from each lot of moss, together with date of col-

[1] Page 168, Footnote.

lection and the weight of the moss examined, from which has been calculated the average number of insects per ton of moss, presuming that the moss examined gives a fair indication of the average inhabitants in that locality. The number of insects likely to inhabit a swamp during the winter, per acre, might also be approximated, but the trees vary so much in their load of the moss, and the number of trees bearing moss in the swamps is also so variable for different locations, that such a calculation would be extremely difficult.

All moss was collected in swamps in the vicinity of Mansura, in Avoyelles Parish, Louisiana, near the center of the state. The collections were made by Mr. Malcolm S. Dougherty, who was located at Mansura in charge of the hibernation experiments carried on by the Crop Pest Commission at that place.

In obtaining the weight of moss in each lot, the gross weight of the moss was first obtained before examining it for its insect contents. During this examination all twigs of any appreciable size were removed, and the weight of these later subtracted from the gross weight of the original lot. In this way the actual weight of the moss itself was gotten.

The moss was examined by placing it upon a table covered with white oilcloth or paper, and tearing it into fine shreds, holding the strands against the light of a window so that any insect in them would be readily seen, while those dropping upon the white tablecover could also be easily collected.

December 15, 1908

13.25 lbs. of *Tillandsia usneoides*

INSECTA.

Species	*No. found in lot*	*Approximate No. per ton*
Paromius longulus	94	14,100
Anthonomus suturalis	40	6,000
Anthonomus grandis	16	2,400
Nezara viridula	14	2,100
Lixus musculus	8	1,200
Bruchus cruentatus	6	900
Mantura floridana	6	900
Spermophagus robiniæ	5	750
Blattid, immature	4	600
Nysius californicus	4	600
Phymata erosa Linn., subsp. fasciata Gray	4	600
Disonycha pennsylvanica	3	450
Sinea spinipes	3	450
Largus succinctus	2	300
Phalacrus penicillatus	2	300
Psyllobora 22-punctata	2	300
Adalia oculata	1	150
Anthonomus scutellatus	1	150

Species	*No. found in lot*	*Approximate No. per ton*
Ceratoma trifurcata	1	150
Chlamys plicata	1	150
Cremastogaster lineolata	1	150
Cymodema exiguum	1	150
Epilachna borealis	1	150
Eudiagogus rosenschœldi	1	150
Hyperaspis signata	1	150
Leptostylus aculiferus	1	150
Pangeus bisulcatus (pupa)	1	150
Sinea sp.	1	150
Triphleps insidiosus	1	150
Tribolium ferrugineum	1	150
Typophorus canellus	1	150
Total Insects	228	34,200
ARACHNIDA		
Grammonota maculata	27	4,050
Anyphæna sp. (young)	4	600
Dendryphantes lineata	2	300
Dictyna foliacea	2	300
Phidippus sp. (young)	2	300
Zelotes sp. (young)	2	300
Herphyllus pallescens	1	150
Oxyopes salticus	1	150
Philodromus diversus	1	150
Runcinia aleatoria	1	150
Theridion spirale	1	150
Total Spiders	44	6,600

December 23, 1908

9.5 lbs. *Tillandsia usneoides.*

INSECTA		
Cremastogaster lineolata	1,075	225,750
Paromius longulus	113	23,730
Anthonomus suturalis	79	16,590
Lixus musculus	18	3,780
Anthonomus grandis	15	3,150
Blattid, immature	13	2,730
Eudiagogus rosenschœldi	8	1,680
Mantura floridana	5	1,050
Psyllobora 22-punctata	4	840
Sinea spinipes	4	840
Bruchus cruentatus	3	630
Nezara viridula	3	630
Phalacrus penicillatus	3	630
Spermophagus robiniæ	3	630
Anthonomus suturalis, var.	2	420
Harmostes fraterculus	2	420
Nysius californicus	2	420
Phymata erosa Linn., subsp. fasciata Gray	2	420

Species	*No. found in lot*	*Approximate No. per ton*
Anthicus pubescens	1	210
Blattid, immature	1	210
Brochymena 4-pustulata	1	210
Caryoborus arthriticus	1	210
Cassida bivittata	1	210
Leptostylus aculiferus	1	210
Lobopoda erythrocnemus	1	210
Tribolium ferrugineum	1	210
Total Insects	1,362	286,020
ARACHNIDA		
Anyphæna fallens (young)	13	2,730
Grammonota maculata	12	2,520
Phidippus audax (young)	8	1,680
Philodromus diversus (young)	5	1,050
Mimetus interfector	3	630
Oxyopes scalaris (young)	3	630
Dendryphantes octavus	2	420
Epeira wittfeldæ (young)	2	420
Clubiona excepta (young)	1	210
Clubiona sp. (young)	1	210
Dictyna foliacea (young)	1	210
Epeira labyrinthea	1	210
Misumena sp. (young)	1	210
Theridium sp. (young)	1	210
Tmarsus caudatus	1	210
Total Spiders	55	11,550

January 6, 1909

14.75 lbs. *Tillandsia usneoides.*

INSECTA		
Cremastogaster lineolata	291	39,285
Paromius longulus	41	5,535
Blattid, immature	6	810
Anthonomus grandis	5	675
Bruchus cruentatus	3	405
Spermophagus robiniæ	3	405
Anthicus pubescens	2	270
Disonycha pennsylvanica	2	270
Phalacrus penicillatus	2	270
Acylamus ergoti	1	135
Agallia 4-punctata (larva)	1	135
Leptostylus aculiferus	1	135
Lixus musculus	1	135
Myochrous denticollis	1	135
Nysius californicus	1	135
Paria canella	1	135
Sinea spinipes	1	135
Tachinid, unidentified	1	135
Total Insects	364	49,140

ARACHNIDA

Species	*No. found in lot*	*Approximate No. per ton*
Grammonota maculata	12	1,620
Mimetus interfector	8	1,080
Philodromus diversus	5	675
Clubiona sp. (young)	4	540
Dendryphantes octavus	3	405
Philodromus sp. (young)	3	405
Clubiona excepta (young)	2	270
Liobunum sp. (young)	2	270
Misumena sp. (young)	2	270
Oxyopes scalaris (young)	2	270
Dolomedes sp. (young)	1	135
Epeira wittfeldæ (young)	1	135
Liobunum vittatum	1	135
Peckhamia picata	1	135
Pisaurinia undata (young)	1	135
Phidippus audax (young)	1	135
Sergiolus bicolor (young)	1	135
Tmeticus tridentatus	1	135
Total Spiders	51	6,885

January 11, 1909

20 lbs. *Tillandsia usneoides.*

INSECTA

Cremastogaster lineolata	96	9,600
Anthonomus suturalis	48	4,800
Paromius longulus	31	3,100
Anthonomus grandis	11	1,100
Eudiagogus rosenschœldi	6	600
Spermophagus robiniæ	5	500
Nysius californicus	4	400
Anthonomus albospilus	3	300
Nezara viridula	2	200
Adalia oculata	1	100
Apion n. sp.	1	100
Bruchus cruentatus	1	100
Cymodema exiguum	1	100
Cyphon obscurus	1	100
Leptoypha mutica	1	100
Zelus sp. (nymph)	1	100
Aræcerus fasciculatus	1	100
Total Insects	214	21,400

ARACHNIDA

Philodromus diversus	29	2,900
Anyphæna sp. (young)	14	1,400
Mimetus interfector	5	500
Oxyopes salticus	4	400
Epeira wittfeldæ	3	300
Liobunum sp. (young	3	300
Phidippus sp. (young)	3	300

Species	*No. found in lot*	*Approximate No. per ton*
Dendryphantes octavus	2	200
Gayenna sp. (young)	2	200
Grammonota maculata	2	200
Phidippus audax	2	200
Euryopsis funebris	1	100
Metacyrba tæniola	1	100
Philæus militaris	1	100
Thanatidius dubius	1	100
Tmarsus caudatus	1	100
Total Spiders	74	7,400

January 20, 1909

27 lbs. *Tillandsia usneoides.*

INSECTA

Paromius longulus	36	2,664
Anthonomus suturalis	26	1,924
Lixus musculus	6	444
Nysius californicus	4	296
Phalacrus penicellatus	4	296
Cremastogaster lineolata	3	222
Disonycha pennsylvanica	3	222
Unidentified Coleoptera	3	222
Nezara viridula	4	296
Harmostes fraterculus	2	148
Phymata erosa Linn., subsp. fasciata Gray	2	148
Psyllobora 22-punctata	2	148
Blattid, immature	1	74
Bruchus cruentatus	1	74
Calleida decora	1	74
Cycloneda munda	1	74
Cyphon obscurus	1	74
Dicerca obscura, var. lurida Fabr.	1	74
Eudiagogus rosenschœldi	1	74
Gryllid, immature	1	74
Sinea spinipes	1	74
Spermophagus robiniæ	1	74
Typophorus canellus	1	74
Total Insects	106	7,844

ARACHNIDA

Dendryphantes octavus	4	296
Grammonota maculata	3	222
Anyphæna sp. (young)	2	148
Phidippus audax	2	148
Epeira wittfeldæ (young)	1	74
Euryopsis funebris (young)	1	74
Philodromus diversus	1	74
Total Spiders	14	1,036

January 27, 1909

14.5 lbs. *Tillandsia usneoides.*

INSECTA

Species	*No. found in lot*	*Approximate No. per ton*
Anthonomus suturalis	89	12,282
Paromius longulus	74	10,212
Lixus musculus	11	1,518
Phalacrus penicellatus	9	1,242
Nysius californicus	7	966
Bruchus cruentatus	6	828
Blattid, immature	5	690
Anthonomus grandis	4	552
Phymata erosa Linn., subsp. fasciata Gray	4	552
Disonycha pennsylvanica	3	414
Brochymena arborea	2	276
Calandra oryzæ	2	276
Gryllid, immature	2	276
Nezara viridula	2	276
Psyllobora 22-punctata	2	276
Sinea spinipes	2	276
Spermophagus robiniæ	2	276
Acylamus ergoti	1	138
Anthonomus suturalis var	1	138
Ceutorhynchus sp.	1	138
Crepidodera rufipes	1	138
Cycloneda munda	1	138
Eudiagogus rosenschœldi	1	138
Haltica ignita	1	138
Tribolium ferrugineum	1	138
Typophorus canellus	1	138
Total Insects	235	32,430

ARACHNIDA

Phidippus audax	4	552
Grammonota maculata	3	414
Anyphæna sp. (young)	2	276
Dictyna sp. (young)	2	276
Oxyopes scalaris (young)	2	276
Philodromus diversus	2	276
Epeira wittfeldæ (young)	1	138
Herphyllus sp. (young)	1	138
Total Spiders	17	2,346

June 6, 1909

17.5 lbs. *Tillandsia usneoides.*

INSECTA

Anthonomus suturalis	3	342
Harmostes fraterculus	2	228
Hemiptera, unidentified	2	228
Mantura floridana	2	228
Diolcus chryssorrhœus	1	114

Species	*No. found in lot*	*Approximate No. per ton*
Spermophagus robiniæ	1	114
Total Insects	11	1,254
ARACHNIDA		
Grammonota maculata	3	342

June 15, 1909

16 lbs. *Tillandsia usneoides.*

INSECTA		
Diolcus chryssorhœus	9	1,125
Mantura floridana	4	500
Blattid, immature	2	250
Total Insects	15	1,875
ARACHNIDA		
Prosthesima n. sp. (young)	5	625

June 21, 1909

15.75 lbs. *Tillandsia usneoides.*

INSECTA		
Cremastogaster lineolata	9	1,143
Blatella dilatator	1	127
Nyctobates pennsylvanica	1	127
Total Insects	11	1,397
ARACHNIDA		
None Taken		

June 22, 1909

13 lbs. *Tillandsia usneoides.*

INSECTA		
Cremastogaster lineolata	6	924
Anthonomus suturalis	2	308
Calandra oryzæ	2	308
Mantura floridana	2	308
Catorama sp.	1	154
Paratenetus sp.	1	154
Solenopsis molesta	1	154
Total Insects	15	2,310
ARACHNIDA		
Grammonota maculata	1	154

June 23, 1909

21 lbs. *Tillandsia usneoides.*

INSECTA		
Mantura floridana	1	95
Philonthus hepaticus	1	95
Total Insects	2	190
ARACHNIDA		
Dendryphantes sp. (young)	1	95
Grammonota maculata	1	95
Prosthesima sp. (young)	1	95
Total Spiders	3	285

Remarks on Insects

Summarizing, we find that there are just 60 genera, representing 65 species of insects, if, for convenience, we count the variety of *Anthonomus suturalis*, taken on December 23d, as a species. That *Tillandsia usneoides* exercises a strong attraction as hibernating quarters for both insects and spiders is plainly shown by the large difference in number of species found in winter and summer lots of Spanish moss, and by the difference, even more striking, between the average number of insects or spiders per ton for the two periods. Of the 60 genera and 65 species of insects found, 53 and 58, respectively, occur in winter, while only 15 genera and species are found in summer. Seven genera and species were found in the June lots which did not occur in the winter lots, and these were found only in very small numbers. Nor is the summer population found in the different lots of moss so regular as that of the winter, only one species being found in four out of the five summer lots of moss, and only three species in as many as two lots. Eleven out of the fifteen species taken in June occur in but one collection of moss, while just one half of the fifty-eight species taken during the winter occur in two or more lots.

By number of insects per ton the average populations of the winter moss was 71,839, while the average of the summer lots is found to be but 1,405 insects per ton. In winter the proportion of spiders per ton to insects per ton is found to be as one to twelve, whereas in summer it is as one to five.

Of the insects taken from the six winter collections of moss

29 species occur in 1 lot
10 species occur in 2 lots
3 species occur in 3 lots
3 species occur in 4 lots
9 species occur in 5 lots
4 species occur in 6 lots

The most widely distributed insects taken during the winter, the number of lots of moss in which they were found, and the average number of insects per ton for the six winter lots, are given below.

Insect	*No. lots in which found*	*Av. No. per ton in 6 winter lots*
Cremastogaster lineolata	5	45,834
Paromius longulus	6	11,557
Anthonomus suturalis	5	6,933
Anthonomus grandis	5	1,313
Lixus musculus	5	1,179
Nezara viridula	5	584
Bruchus cruentatus	5	489
Nysius californicus	6	469

Insect	*No. lots in which found*	*Av. No. per ton in 6 winter lots*
Phalacrus penicellatus	5	456
Eudiagogus rosenschœldi	5	440
Spermophagus robiniæ	6	439
Sinea spinipes	5	296

In the winter lots *Cremastogaster lineolata* occurs at the head of the list of species collected, ranked by number per ton, three times. *Paromius longulus* occurs first twice, second three times and third once. In summer this species is not found at all. *Anthonomus suturalis* is found first once, second three times and third once. *Lixus musculus* occurs third twice, fourth once and fifth once. It will be observed that several species which are found in only five of the six winter collections of moss, occurred in these lots in such large numbers that, in average number per ton for the six lots, they stand higher than several species which were found in every lot collected.

Probably the most striking figure in this article is that of 1,313 boll-weevils per ton of moss as the average for the winter moss. Messrs. Newell and Dougherty have shown [2] that Spanish moss carried boll-weevils over the winter better than any other hibernating material, and an average number of over a thousand of these dangerous insects to each ton of moss in a central Louisiana swamp would certainly furnish a vast number of unwelcome guests to the nearby cotton-planters.

Of the insects found in the five lots of moss collected in June, we find only four occurring in more than one lot. These are

Insect	*No. lots in which found*	*Av. No. per ton in 5 summer lots*
Cremastogaster lineolata	2	413
Diolcus chryssorrheus	2	248
Mantura floridana	4	226
Anthonomus suturalis	2	130

It is significant that not one boll-weevil was found in summer.

Remarks on Spiders

Of spiders there are 28 genera, representing 40 species, 27 genera and 38 species occurring in the winter collections. In the summer only three genera and species are found, one genus, *Prosthesima*, not occurring in the winter, and the undetermined species of *Dendryphantes* is also lacking in the winter collections.

The average spider population of the six lots of moss collected during the cooler months is found to be 5,969 per ton, while for the June lots it falls to 281 per ton. Of the spiders taken from the six winter

[2] Circular 31, State Crop Pest Commission of Louisiana, 1909.

collections of moss, 21 species were found to occur in one lot only, 9 species in two lots, and 2 species each in three, four and all five lots.

The most common spiders taken during the winter, the number of lots of moss in which they were found and the average number of Arachnids per ton for the six winter lots, are given below.

Spider	*No. lots in which found*	*Av. No. per ton in 6 winter lots*
Grammonota maculata	6	1,504
Philodromus diversus	6	854
Anyphæna sp.	4	606
Anyphæna fallens	1	455
Phidippus audax	5	452
Mimetus interfector	3	368
Dendryphantes octavus	4	220
Oxyopes scalaris	3	196
Epeira wittfeldæ	5	178

Grammonota maculata and *Philodromus diversus* occur in all six winter lots, the former twice leading the list of spiders arranged by number per ton, and occurring second three times. It occurs tenth once.

The following three species were the only ones found in the June collections.

Spider	*No. lots in which found*	*Av. No. per ton in 5 summer lots*
Prosthesima n. sp.	2	144
Grammonota maculata	3	118
Dendryphantes sp.	1	19

Acknowledgments

The writer wishes to acknowledge his sincere thanks to Dr. L. O. Howard, for his kindness in having various insects identified, to Dr. W. M. Wheeler for the identification of most of the ants listed herein, to Prof. E. A. Schwartz for the identification of the larger number of the Coleoptera listed, to Prof. Otto Heidemann for the identification of most Hemiptera, to Prof. H. S. Barber for identifying *Scymnus collaris, Elaphidion parallelum, Haltica ignita* and *Nyctobates pennsylvanica*, to Prof. A. N. Caudell for identifying *Blatella dilatator*, and to Prof. Nathan Banks for the identification of all spiders.

ENTOMOLOGICAL MEETINGS, DECEMBER, 1911

The annual meeting of the American Association of Economic Entomologists, Entomological Society of America and Association of Official Horticultural Inspectors will be held during the Christmas holidays at Washington, D. C. Partial arrangements for the meetings are already under way and the attention of the entomologists is called to the matter at this time, so that they may know what progress is being made and plan in advance to attend.

The Entomological Society of America will meet on Tuesday and Wednesday, December 26 and 27. It is expected that a joint meeting will be held on one of these days with the American Association of Economic Entomologists; and if suitable arrangements can be made the first session of the meeting of the latter association will begin Wednesday.

The meetings will continue on Thursday, both morning and afternoon, and in the evening the opening session of the Association of Official Horticultural Inspectors will be held.

Friday morning the final session of the American Association of Economic Entomologists will be held and the rest of the day will be devoted to meetings of the Horticultural Inspectors.

Considerable difficulty has been experienced in arranging the meetings this year on account of the limited time which is available, and because of the fact that the meetings will probably be the largest and most representative of any that the associations have held.

Foreign members of the Association of Economic Entomologists are requested to forward at once the titles of any papers that they may wish to present at the meeting and the manuscript should be mailed so that it will be received not later than December 15, 1911.

Members wishing to recommend candidates for membership should apply to the undersigned as soon as possible for application blanks, so that they can be filled out and returned before the meeting in order that the membership committee may have time to act on as many applications as possible before the meeting.

A. F. BURGESS, *Secretary, A. A. E. E.*

Through the recent unification of the South African Colonies, the entomological work which has heretofore been done by separate men working independently will now be consolidated into the Division of Entomology, Union Department of Agriculture, with headquarters at Pretoria. Mr. Charles P. Lounsbury, Government Entomologist, Cape of Good Hope, has been made Chief of the Division.

JOURNAL OF ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

AUGUST, 1911

The editors will thankfully receive news items and other matter likely to be of interest to subscribers. Papers will be published, so far as possible, in the order of reception. All extended contributions, at least, should be in the hands of the editor the first of the month preceding publication. Reprints may be obtained at cost. Contributors are requested to supply electrotypes for the larger illustrations so far as possible. The receipt of all papers will be acknowledged.—Eds.

The annual midsummer dominance of the house fly is at hand, together with a large crop of newspaper paragraphs and popular articles in regard to the situation. It is evident that correct information is much more widely distributed than in earlier years though there are still occasions where the guiding hand of the entomologist might have bettered matters. The present is an excellent time to create a favorable sentiment for coöperation in communities for the purpose of controlling flies, even though nothing more than a start be made this season.

The general interest in insects as disease carriers is strikingly shown in the ten-page bibliography appearing elsewhere in this issue and listing only the more important contributions during 1910 to this phase of economic entomology. Reference to the list shows that the results of these recent investigations are being incorporated in various text books and general works. There is also a perceptible widening in the sphere of study. Mosquitoes and flies, with special reference to their part in the dissemination of malaria, yellow fever and typhoid fever, still receive attention, but in addition there is a voluminous literature dealing with the relation of flies to other diseases, especially sleeping sickness. Plague and its connection with rats, squirrels and fleas has been a subject of prime importance on the Pacific coast. The part body parasites may have in the spread of disease has aroused active interest on the part of several investigators. Only recently a painful cutaneous eruption has been definitely associated with a predaceous and hitherto supposedly entirely beneficial mite.

The recent action of the George Washington University in conferring the honorary degree of Doctor of Medicine upon an entomologist, for "distinguished services to science in relation to preventive medicine," is gratifying testimony to the position entomological knowledge

is taking in the estimation of our progressive medical men. It is a well earned reputation. The entomologist, the moment there seemed to be a vital connection between infectious diseases and insects, undertook systematic and biological investigations which soon resulted in opening up new realms of thought and demonstrated the economic importance of the well-known, yet up to recently, almost unknown house fly. This insect—formerly ignored, accepted as an inevitable associate of man, considered hardly worthy of jocose treatment—has now risen to the dignity of an important insect. It is the subject of paragraphs innumerable, and now our learned associate in Washington has demonstrated the possibility of writing a popular and interesting book on this hitherto much despised insect. This represents only one phase of the relation of entomology to medicine. The successful campaigns waged against malaria in various parts of the world depend for success very largely upon our systematic and biological knowledge of certain mosquitoes. The deadly yellow fever is controlled with the subjection of a different mosquito, and this is another signal triumph of practical or economic entomology in the field of medicine. The connection of the wide-spread African blight known as sleeping sickness, with the malignant Tsetse fly is an additional instance where entomology and medicine have coöperated. No word is necessary to demonstrate the importance of biological investigations of these disease carriers. Many valuable facts have been learned respecting these forms in recent years and capable investigators are searching for additional information which will be of value in the campaign against disease-carrying insects.

The scientific meetings shortly to be held at Washington will rank among the largest and most representative of such gatherings. There will be an excellent opportunity on the part of all participants to exercise commendable self-restraint. The more papers and discussions, especially if meaty and to the point (and no others should be submitted) the better. Let us cultivate the fine art of preparing papers embodying all the essentials yet praiseworthy because of the omission of prolix and often irrelevant details. It is well known that many extremely important points are brought out in discussions. These latter can occur only, especially at this meeting, if each man limits himself rigidly to the essentials. All presenting papers should remember that they are talking to an unrivaled assemblage of experts and gauge their statements accordingly.

Reviews

The House Fly—Disease Carrier, an Account of Its Dangerous Activities and of the Means of Destroying it, by L. O. HOWARD. New York. Frederick A. Stokes Co., 1911, pp. I–XIX, 1–312.

This admirable work discusses all phases of the fly problem in a non-technical manner and yet with such scientific accuracy that the economic entomologist will find therein much of value, especially as it summarizes the latest developments in solving the fly problem. Some sixty pages are devoted to a discussion of the zoölogical position of the insect, its life history and habits. There are in this chapter a number of extremely valuable suggestions for future investigations. Natural enemies of the fly are considered in some detail as well as the insect's place in the dissemination of a number of diseases. The fifty odd pages dealing with remedial and preventive measures discuss fully the various problems involved, considerable attention being given to the coöperation necessary in cities and villages. The final chapter comprises accounts of a number of species occurring in houses. The bibliographical list will prove of much service to those interested in the original sources of information. The appendices contain much valuable information in regard to flies occurring in manure and kitchens, the regulations of the health department of the District of Columbia relating to house flies and methods of constructing and maintaining sanitary privies. The volume as a whole is a distinct addition to our knowledge concerning this most important insect, and the author, in the preparation thereof, has rendered a material service, not only to the general public but to all workers interested in this line of effort. The illustrations are excellent and the letter press admirable.

Scientific Notes

Rose leaf hopper (*Typhlocyba rosæ* Linn). An examination of available literature shows that this insect is supposed to hibernate in the adult stage, yet an investigation of rose bushes in the fall, during winter and in early spring, failed to reveal any such adults in the vicinity of the bushes. Some shoots were brought in in early spring before the foliage had started, and the eggs were found deposited singly just under the new bark. Their location is indicated by an almost imperceptible, oval elevation in the bark, about 1 mm. long and presenting a slight greenish or yellowish discoloration, occasionally accompanied by increased transparency, due to the egg beneath. There is at one end of the elevation a very slight scar made at the time the egg is deposited. This latter is quite different from the elongate lenticel seen upon the wood. It is comparatively easy to expose the eggs by simply rupturing the bark on either side with a needle and raising it. The egg has a length of .7 mm., a diameter of .2 mm. It is narrowly oval, the anterior extremity broadly rounded, while near the posterior third there is a slight curve, the posterior extremity being narrowly rounded. It is semi-transparent. April 17 material taken in the field contained a semi-transparent, yellowish embryo, with a length about one third that of the egg, and showing an indistinct segmentation. May 14 nymphs were numerous on the lower leaves especially, their presence being indicated by the rather characteristic white spots along the veins. The abundant growth above these affected leaves obscures, in large measure, the early signs of this insect. The injury becomes more

marked on the lower leaves as the season advances. May 25 the nymphs were about three fourths grown. The first adults were observed June 3.

Miastor. Recent collecting has resulted in finding the larvæ in the decaying bark of maple, chestnut, oak, birch, beech and hickory, rearings confirming the identity in all cases except one. In addition, a species of Oligarces has been obtained from decaying elm bark. The vitality of Miastor larvæ is amazing. Some have lived and propagated for nearly six months in a small piece of decaying wood lightly clamped to a microscopic slide, while individual larvæ were kept in sealed water cells for about four weeks. The latter were subjected to daily examinations with a microscope, and in spite of the adverse conditions, the vital processes continued and the embryos developed though slowly. We were fortunate, in the case of two larvæ, to witness the development of the egg in the ovary, its separation by fission and the growth of the embryo to an individual ready to escape from the mother larva. The development of the embryo is at the expense of the mother, pulsations continuing in the latter so long as a fragment of the dorsal vessel remains. In one specimen observed, the dorsal vessel was ruptured in the vicinity of the sixth body segment, and the free anterior portion continued violent pulsations and irregular wrigglings till the next day, at which time the movements were much slower and the following day had disappeared entirely. An indefinite number of pedogenetic generations succeed each other. The appearance of the two sexes is presaged by the larvæ developing distinct breastbones, soon followed by a change to the prepupa. This stage has a duration of two to three days and is characterized by a marked swelling and transparent condition of the anterior body segments of the larva, the portion occupied by the pupal head and thoracic region. The duration of the pupal stage is from three to six days, numerous adults appearing within a few days and emerging from their habitat in the late morning hours, approximately from 9 a. m. to noon. Miastor larvæ are actively preyed upon by the pinkish larvæ of Lestodiplosis and also the larger predaceous maggots of *Lonchæa polita* Loew and a species of *Medeterus*. It not infrequently happens in nature that an abundance of the larvæ of these two latter is about the only available evidence of the earlier occurrence of Miastor larvæ, though exploration of the bark beyond where these predaceous enemies occur, frequently results in finding colonies of Miastor.

E. P. Felt

A Correction. In my paper, "Further Notes on the Aphididæ Collected in the Vicinity of Stanford University," Journal of Economic Entomology, August, 1910, p. 372, I described an aphid of the genus *Pemphigus* on the California buttercup (*Ranunculus californicus*) giving it the name of *Pemphigus ranunculi* sp. nov. According to the new rules in Zoölogical nomenclature this specific name does not hold good since Kaltenbach described an European species under the same name (Monog. Pflz. 1843), although the latter has been lately regarded as a synonym for *Pemphigus affinis*. Accordingly I propose the name of *Pemphigus californicus* Davidson. Mr. E. O. Essig has lately sent me examples of this insect labeled "on *Ranunculus californicus* Benth., Nordhoff, Cal."

W. M. Davidson

Current Notes

Conducted by the Associate Editor

At the recent session of the Nebraska legislature a bill (H. R. 576) was passed making important changes in the administration of the office of State Entomologist. Previously, the Professor of Entomology of the University of Nebraska (Prof. L. Bruner) was authorized by law to act as state entomologist, and the legislature made appropriations from the general fund of the state to cover the necessary expenses for carrying on entomological work, which were expended under the direct control and supervision of the acting state entomologist. Under the new arrangement, the control of the office is vested in the Board of Regents of the University, who are empowered to designate one of the teaching staff of the University to act as state entomologist, and to administer and expend the funds appropriated for entomological work from the general fund of the state as they do university funds generally. The Board of Regents are also empowered to make, from time to time, such rules and regulations governing the duty of the entomologist to the people of the state as it deems wise, and are required to see that such services shall not interfere with the prime duties of the entomologist as a teacher and investigator. The legislature appropriated a sum of $5,000.00 for the biennium to be expended in the investigation and control of the insect pests of the state. Prof. Lawrence Bruner was subsequently designated by the board to be state entomologist. The complete working staff of the office at the present time is as follows: Prof. L. Bruner, entomologist; Prof. Myron H. Swenk, assistant entomologist; Mr. J. T. Zimmer, field expert, and Messrs. R. W. Dawson and L. M. Gates, laboratory and field assistants. The work of the current year consists largely of an intensive study of grasshopper control measures while special investigations of the pine-tip moth, wheat-root aphid, melon aphis and other important insect pests are also in progress.

Mr. W. W. Froggatt, government entomologist of New South Wales, has been appointed Lecturer in Economic Entomology to the Chair of Agriculture of the Sydney University. This appointment is for a period of seven years, and carries a salary of five hundred dollars. The work will be carried out in conjunction with Mr. Froggatt's present official work, and the appointment is the first of its kind in Australia. Mr. Froggatt has also been elected president of the Linnæan Society of New South Wales, the leading scientific society in Australia. Since the death of its founder, Sir William Macleay, nearly twenty years ago, no entomologist has until now held the office of president.

At Clemson College, S. C., the entomological work in the college and station have been combined, and A. F. Conradi has been made professor of entomology in the college in addition to his work as station entomologist. W. P. Gee has been appointed assistant professor of entomology in the college.

According to *Science*, William B. Herms, assistant in entomology at the University of California, is on a visit to Europe, where during the summer he expects to visit the principal parasitological laboratories of England, France, Germany and Italy. He will also represent the University of California as a delegate to the International Hygiene Exhibit at Dresden.

In June, 1911, Mr. Paul Hayhurst was made professor of entomology at the University of Arkansas, Fayetteville, Ark., and also entomologist of the station, and state nursery inspector. Mr. George G. Becker has been appointed assistant.

Purdue University has recently established a new department of entomology, with Prof. James Troop as its head. Professor Troop has taught both horticulture and entomology for twenty-seven years. Now he will give his entire time to entomology.

P. H. Hertzog of Bucknell College, formerly of the Laboratory of Economic Zoölogy at Harrisburg, Pa., is assistant for the summer in the Bureau of Entomology, department of cereal and forage insect investigations, under Prof. F. M. Webster.

According to *Science*, Dr. Robert Newstead, lecturer in economic entomology and parasitology in the Liverpool School of Tropical Medicine, has been appointed to the newly established Dutton Memorial Chair of Entomology in the University of Liverpool.

F. C. Craighead of State College, Pennsylvania, is now connected with the Bureau of Entomology, in the department of forest insect investigations, under Dr. A. D. Hopkins.

The legislature of Oregon has made an appropriation of $25,000 annually to the Experiment Station, $15,000 of which is to be used in the investigation of crop and fruit pests and other horticultural problems.

Prof. L. Bruner, State Entomologist of Nebraska, is spending the summer on his farm near Worland, Wyo. During his absence the entomological investigations in Nebraska are being directed by his assistant, Prof. Myron H. Swenk. At a recent meeting of the Board of Regents of the University, Professor Swenk was promoted to the rank of associate professor.

Dr. L. O. Howard was recently elected a member of the American Philosophical Society.

Dr. E. W. Berger, entomologist of the Florida Experiment Station, has resigned to accept the position of inspector of nursery stock for the state of Florida. Mr. Berger began his new duties July 1st with his office in the Experiment Station Building, Gainesville, Fla.

Mr. U. C. Loftin, laboratory assistant to the entomologist of the Florida Agricultural Station, has resigned to teach agriculture in a high school in Texas.

Mr. F. C. Pratt died at Dallas, Tex., on May 27, 1911. He was one of the oldest employees of the Bureau of Entomology. His service began in 1892 and extended over a period of nineteen years. An Englishman by birth, Mr. Pratt's early entomological training was obtained in the British Museum and in the Rothchild Museum at Tring. For the past five years he was connected with the Southern Field Crop Insect Investigation of the Bureau of Entomology. A more extended notice will appear in the next issue of the Proceedings of the Entomological Society of Washington.

Mr. D. W. Coquillett, widely known as the leading American Dipterist, died July 8, 1911, at Atlantic City, N. J., at the age of fifty-four.

Mailed August 15, 1911.